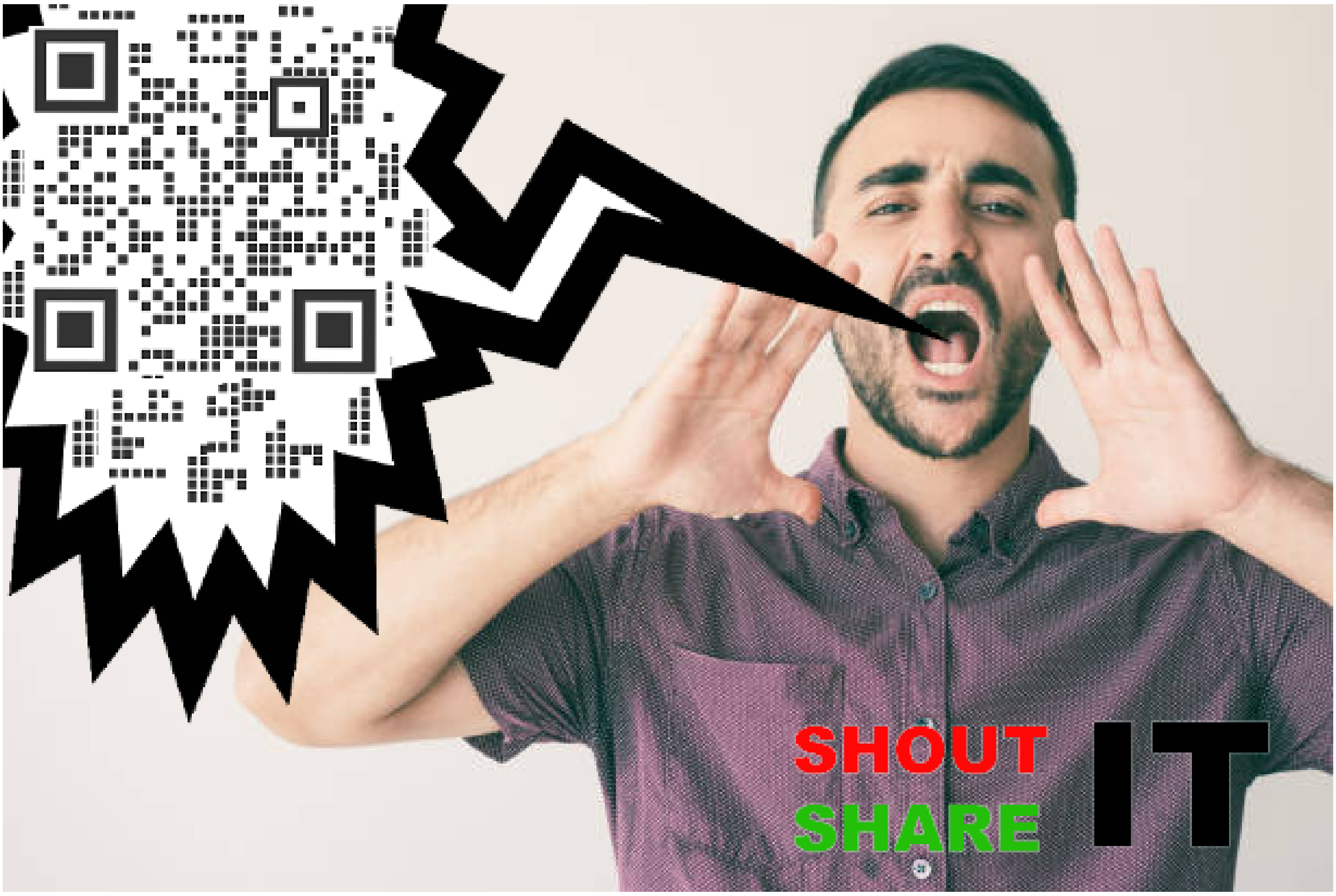
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THE BRITISH MUSEUM
(NATURAL HISTORY)

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1951—1955

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ERRATA

P. 6. For *M. microsciadia* read *M. macrosciadea.*

P. 11. For *P. paucidens* read *T. paucidens.*

P. 11. For *P. philippinensis* read *T. philippinensis.*

P. 22. For *Mastichodendron foetidissima* read *Mastichodendron foetissimum.*

11 JUN 1951

CONTRIBUTIONS TO OUR KNOWLEDGE OF OLD WORLD ARALIACEAE

W. R. PHILIPSON

WILLIAM RAYMOND

AN UNDESCRIBED SPECIES OF *MASTICHODENDRON* (SAPOTACEAE) FROM BARBADOS AND ANTIGUA

H. E. BOX AND W. R. PHILIPSON

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CONTRIBUTIONS TO OUR KNOWLEDGE OF OLD WORLD ARALIACEAE

By W. R. PHILIPSON

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I. A REVISION OF THE GENUS *MACKINLAYA* F. MUELL. (WITH *ANOMOPANAX* HARMS)

THE range of the genus *Mackinlaya*, as it is treated in the present revision, that is, with the inclusion of *Anomopanax*, extends from Celebes and the Philippines, through New Guinea to the Solomons and Queensland. The genus first became known at the two extremes of its range, in Queensland and Celebes, and the species from these places were put into separate genera. The subsequent discovery of several species in New Guinea leaves no doubt that the two genera should be united. It is unfortunate that most species have been attributed to the more recent of the two genera, so that several new combinations are required.

The genus *Mackinlaya* was founded by Ferdinand von Mueller in 1864 to include a very distinctive araliaceous plant from Queensland which he had described four years earlier as a species of *Panax*. The genus remained monotypic until 1909, when Hemsley distinguished another species (*M. confusa*) from Queensland and one (*M. amplifolia*) from Dutch New Guinea. No further species have been described in the genus until the present. When Harms, in 1902, described three Malaysian plants as species of a new genus, *Anomopanax*, he recognized their relationship with the Australian genus *Mackinlaya*, but considered that their slightly different inflorescence, together with the distinct geographical distribution as then known, justified the description of a new genus. However, when a species was found in New Guinea (*A. schlechteri*) he expressed doubts as to the validity of his own genus.

Since that time four more species of *Anomopanax* have been described from New Guinea and the Philippines. All the species agree with the original species of *Mackinlaya* in habit, and in having leaves either palmately divided or reduced to a single leaflet (not infrequently the central leaflet, or the three central leaflets, are either lobed or compound, a character rarely found in other genera of the Araliaceae). Another foliar character rare in the family is the insertion of the leaf-sheath round the whole circumference of the stem. It is a character present in a section of the genus *Polyscias*, but is more typical of the Umbelliferae. A floral character shared by all the species of *Mackinlaya* and *Anomopanax* is the narrow base of the petal; this also is very rare in the family, but is characteristic of the Umbelliferae. The constantly 2-locular ovary is also more typical of the Umbelliferae than the Araliaceae, but the other characters of the fruit appear to justify the retention of these plants in the Araliaceae. The possession of so many exceptional characters in common far outweighs a technical character of the inflorescence branches, which has been the sole basis for maintaining the second genus.

Most of the species are restricted in their distribution, but throughout the range of the genus, except in Australia, plants are found with inflorescences whose finer branches divide repeatedly and whose palmate leaves have the central lobe or lobes compound in their turn, so that a pseudo-pinnate leaf frequently results. Several names have been applied to these plants in different regions, namely, in Celebes *A. celebicus*, in the Philippines *A. philippinensis*, in Dutch New Guinea *A. arfakensis* and *M. amplifolia*, and in Papua *A. variaefolius*. The authors of *A. philippinensis* and *A. variaefolius* both suggest that their species may prove to be conspecific with *A. celebicus*; I think they were justified and prefer to treat the complex as a single variable species rather than attempt to distinguish micro-species before the flora of these islands is much more fully known. As these plants occasionally bear leaves which are simply palmate (i.e. with undivided leaflets) specimens may resemble *M. confusa* rather closely. The occurrence of the simply palmate leaves in New Guinea appears to be merely the result of variation of leaf shape so common in the family, for specimens that bear them may also bear more complex leaves. On the other hand, the Queensland plants appear to bear simply palmate leaves without exception, and for this reason are retained as a distinct species.

I have found it necessary to increase the number of species with simple, or predominantly simple, leaves from two to five. All occur in New Guinea, and all are known from restricted areas. Probably other local species belonging to this group will be found in the future.

I wish to express my thanks to Dr. W. B. Turrill for permission to work on these plants in the Kew Herbarium, and to the authorities of the herbaria of the Arnold Arboretum and the Botanic Garden, Buitenzorg, for the loan of specimens.

MACKINLAYA

F. Muell., *Fragmenta*, **4:** 119 (1864)

Anomopanax Harms in *Ann. Jard. Bot. Buitenzorg*, **19:** 13 (1902).

Glabrous shrubs, often unbranched (sympodial). Leaves with a petiole having a dilated sheath encircling the stem and (in dried material) a constriction at the apex, and with a leaf-blade either unifoliolate or digitately compound, the central leaflet, or the three central leaflets, sometimes digitately lobed or compound. Inflorescence terminal (but sympodium often continued by axillary branching), the peduncle bearing umbellately arranged branches which terminate either in umbellules or in cymes. Flowers male or hermaphrodite, the male flowers either in distinct inflorescences or towards the periphery of mixed inflorescences. Calyx-lobes 5–6, triangular or lanceolate. Petals 5–6, narrowed below into a distinct claw, and above into a long incurved process. Stamens 5–6; anthers sub-globose. Ovary articulated with the pedicel, inferior, with two uni-ovulate loculi. Disk prominent, with a crenulate margin. Styles two, subulate, free, recurved in fruit. Fruit strongly compressed, two-seeded (or one aborted), with a longitudinal furrow between the seeds.

Key to the Species

Pedicels in umbellules.
Rays of umbellules very numerous, radiating in all directions; leaves compound.
Umbellules about 2 cm. in diam.; leaves simply palmate . 1. *macrosciadea*
Umbellules about 4 cm. in diam.; central leaflet compound 2. *radiata*
Rays of umbellules about 20, or fewer, ascending; leaves simple, or rarely some compound.
Principal nerves 1·0–1·5 cm. apart at centre of lamina . 3. *brassii*
Principal nerves 2·0–2·5 cm. apart at centre of lamina.
Sepals triangular, 0·5 mm. long . . . . . . 4. *klossii*
Sepals linear, 1·0 mm. long . . . . . . 5. *subulata*

Pedicels not in umbellules.
Leaves simple.
Leaves ovate (about twice as long as broad) . . . 6. *vertseegii*
Leaves ovate-lanceolate (about three times as long as broad) 7. *schlechteri*
Leaves compound.
Leaves simply palmate.
Peduncle about 1 cm. long . . . . 8. *digitata*
Peduncle about 10 cm. long, or longer.
Sepals linear, 1·0 mm. long . . . . . . 9. *warburgii*
Sepals triangular, 0·5 mm. long . . . . . . 10. *confusa*
Central leaflet(s) compound . . . . 11. *celebica*

1. *Mackinlaya macrosciadea* (F. Muell.) F. Muell., *Fragmenta*, **4**: 120 (1864).

Panax macrosciadeus F. Muell., *Fragmenta*, **2**: 108 (1860).

Queensland: Shoal Bay Passage, *R. Brown*, 6347. Fitzroy Island, *Cunningham*, 128; *Hill*, 143; *MacGillivray*, 269*b*. Rockingham Bay, *Dallachy*, s.n. South of Mackay, rain-forest at foot of range west from Koumala, *Francis*, s.n. Strathdickie, in cool shaded forest, *Michael*, 1051. Tinan Creek, Wide Bay District, light rain-forest in sandy soil bordering creek, *C. T. White*, 3518. Byfield, near Keppel Bay shrub, in light rain-forest, along creek bank, *C. T. White*, 8172 (fruits blue).

Specimens distributed by Mueller are probably of the type gathering, but none that I have seen is precisely localized.

2. **Mackinlaya radiata** Philipson, *sp. nov.*

Frutex simplex glaber, 1·5 m. altus. *Folia* petiolis c. 20 cm. longis basi in vaginam amplexicaulem dilatatis, apice constrictis; laminis digitatis, 5-foliolatis; foliolis infimis brevissime petiolulatis (c. 1 cm.), foliolis intermediis longe petiolulatis (c. 7 cm.), laminis foliolorum lateralium ellipticis, usque ad 20×12 cm., basi breviter cuneatis, apice acutis, margine apicem versus dentatis; foliolo terminali longe petiolulato (c. 11 cm.), lamina tripartita, lobis ellipticis vel oblongo-ellipticis, usque ad 20×12 cm. lobo terminali stipitato (c. 5 cm.). *Inflorescentia* magna; pedunculo crasso striato, ad apicem bracteato, bracteis anguste lanceolatis; ramis primariis c. 50, ad c. 18 cm. longis, pedicellis c. 130 per umbellulam, tenuibus, c. 2 cm. longis. *Flores* articulati; calycis lobis 5, triangularibus, c. 0·5 mm. longis; petalis 5, basi unguiculatis; staminibus 5, antheris oblongis; disco margine undulato; ovario turbinato, 0·7 mm. longo. *Fructus* adhuc ignotus.

NETHERLANDS NEW GUINEA: 4 km. south-west of Bernhard Camp, Idenburg River, one plant in mossy forest at 900 m., *L. J. Brass*, 13094 (type in British Museum).

The compound umbel of this species is similar to that of *M. microsciadia*, but the spherical umbellules are twice as large as those of that species. The leaves resemble those of *M. celebica*.

3. **Mackinlaya brassii** Philipson, *sp. nov.*

Frutex glaber, nanus, caule simplici. *Folia* simplicia; petiolis ad 1·5 cm. longis, basi in vaginam amplexicaulem dilatatis, lamina membranacea, lanceolata vel ovato-lanceolata, basi in petiolum angustata, apice acuta, margine remote dentata vel undulata, usque ad 18×6 cm., nervis lateralibus utrinsecus c. 10. *Inflorescentia* terminalis; pedunculo tenuo, 6 cm. longo, ad apicem bracteato, bracteis anguste lanceolatis usque ad 7 mm. longis; ramis primariis c. 7, ad 5 cm. longis, ad apicem bracteatis, bracteis anguste lanceolatis usque ad 5 mm. longis; pedicellis c. 15 per umbellulam, ad c. 1·5 cm. longis, raro ramosis. *Flores* articulati; calycis lobis 5, anguste triangularibus, c. 0·75 mm. longis; petalis 5, basi unguiculatis; staminibus 5, filamentis c. 2.5 mm. longis, antheris 0.5 mm. longis; disco margine undulato; ovario oblongo, 3×1.5 mm.

PAPUA: Palmer River, 2 miles below junction of Black River, altitude 100 m.; rare in forest undergrowth, *L. J. Brass*, 7322 (type in Arnold Arboretum).

Similar in habit to *M. schlechteri*, but with more numerous veins in the leaf, and with the pedicels arranged in umbels.

4. **Mackinlaya klossii** Philipson, *sp. nov.*

Anomopanax schlechteri (non Harms) Ridley in *Trans. Linn. Soc. Lond., Ser. 2, Bot.*, **9**: 63 (1916), pro parte.

Frutex glaber. *Folia* simplicia vel digitata, petiolis ad 5 cm. longis, basi in vaginam amplexicaulem dilatatis, lamina (vel foliolis) lanceolata, basi in petiolum angustata, apice longe acuminata, margine denticulata, usque ad 24×6 cm., nervis lateralibus utrinsecus c. 6. *Inflorescentia* terminalis vel pseudolateralis; pedunculo c. 15 cm. longo, ad apicem bracteato, bracteis anguste lanceolatis usque ad 1 cm. longis;

ramis primariis c. 15, c. 5–10 cm. longis; pedicellis c. 10–15 per umbellulam, 5–10 mm. longis. *Flores* articulati calycis lobis 5, triangularibus, c. 0·5 mm. longis; petalis 5, unguiculatis; staminibus 5, antheris oblongis; disco margine undulato; ovario compresso, 2×2 mm. *Fructus* c. 10×15 mm.

NETHERLANDS NEW GUINEA: Tsingarong River, Camp VI*b*, 3,900 ft., *Kloss*, s.n. (type in British Museum). Kemarong River, Camp VI*c*, 5,500 ft., *Kloss*, s.n.

This species resembles *M. schlechteri* in habit, but has the pedicels arranged in umbels. It differs from *M. brassii* in the venation of the more chartaceous leaves.

5. **Mackinlaya subulata** Philipson, *sp. nov.*

Frutex glaber, nanus, caule simplici. Folia simplicia; petiolis ad 3 cm. longis, basi in vaginam amplexicaulem dilatatis, lamina obovato-lanceolata, basi in petiolum angustata, apice breviter acuminata, margine minute dentata, usque ad 14×5 cm., nervis lateralibus utrinsecus c. 6. *Inflorescentia* terminalis; pedunculo tenuo, ad apicem bracteato, bracteis lanceolatis, usque ad 1 cm. longis; ramis primariis c. 7, ad c. 4 cm. longis, ad apicem bracteatis, bracteis ad 5 mm. longis; pedicellis c. 18 per umbellulam, c. 1·5 cm. longis. *Flores* articulati; calycis lobis 5, linearis, c. 1 mm. longis; petalis 5, unguiculatis; staminibus 5, antheris oblongis; disco margine undulato; ovario adhuc ignoto.

NEW GUINEA (Australian Mandate): Kani Mountains, 1,000 m., *R. Schlechter*, 17723 (type in Arnold Arboretum).

Similar to *M. schlechteri* in habit, but with the pedicels arranged in umbels. It differs from *M. klossii* in the linear sepals and the more membranaceous leaves.

6. **Mackinlaya versteegii** (Harms) Philipson, *comb. nov.*

Anomopanax versteegii Harms in Lorentz, *Nova Guinea*, **8**: 276 (1910).
Anomopanax schlechteri (non Harms) Ridley in *Trans. Linn. Soc. Lond., Ser. 2, Bot.* **9**: 63 (1916), pro parte.

NETHERLANDS NEW GUINEA: Noordfluss, *Vertseeg*, 1419 (type). Setakwa River, Canoe Camp, 150 ft., *Kloss*, s.n.

7. **Mackinlaya schlechteri** (Harms) Philipson, *comb. nov.*

Anomopanax schlechteri Harms in Schum. & Laut. *Nachtr. Fl. Deutsch. Südsee:* 332 (1905).

NEW GUINEA (Australian Mandate): Torricelli Mountains, 1,000 m., *Schlechter*, 14363 (type).

8. **Mackinlaya digitata** (Merrill) Philipson, *comb. nov.*

Anomopanax digitatus Merrill in *Philipp. J. Sci.*, **17**: 301 (1920).

PHILIPPINES: Siargao, Bur. Sci. 34925, *Ramos & Panasio* (type).

I have not seen this species; its position in the key is based on the characters given in the original description.

9. **Mackinlaya warburgii** (Harms) Philipson, *comb. nov.*

Anomopanax warburgii Harms in *Ann. Jard. Bot. Buitenzorg,* **19:** 15 (1902).

CELEBES: Mt. Bonthain, 1,850 m., *Bünnemeijer,* 12304, 12408.

The type specimen (between Manipi and Leia, *Warburg,* 16137) has not been seen as it was destroyed, so far as is known, during the war of 1939–45.

10. **Mackinlaya confusa** Hemsl. in *Bull. Misc. Inform. Kew,* **1909:** 259 (1909).

M. macrosciadea (non F. Muell.) Benth. in *Fl. Austral.* **3:** 383 (1866), pro parte.

QUEENSLAND: Rockingham Bay, *Dallachy,* s.n. Bellenden Ker, common to dominent in secondary growth in forest at 5,400 ft., *Gibbs,* 6324. Dunk Island, *MacGillivray,* 269 (type in Kew Herb.). Kuranda, 1,200 ft., *Podenzana,* s.n. Thornton Peak, 700–1,000ft., *Brass & White,* 303; 1,000–2,000 ft., *Brass,* 2330. Cook District, Etty Bay, common as undergrowth in rather light rain-forest, *C. T. White,* 11716 (fruits juicy, light blue, shining).

11. **Mackinlaya celebica** (Harms) Philipson, *comb. nov.*

Anomopanax celebicus Harms in *Ann. Jard. Bot. Buitenzorg,* **19:** 14 (1902).
Anomopanax philippinensis Harms, *l.c.* 15.
Mackinlaya amplifolia Hemsley in *Bull. Misc. Inform. Kew,* **1909:** 260 (1909).
Anomopanax arfakensis Gibbs, *Phytogeog. Arfak Mts.* 163 (1917).
Anomopanax variaefolius C. T. White in *J. Arnold Arbor.* **10:** 256 (1929).

CELEBES: Minahasa, *Koorders,* 16109*b* (type), 16110*b*, 16112*b*. *Kjellberg,* 994.

PHILIPPINES: Negros; Dumaguete, *Elmer,* 9516; *Curran,* 17355. Mindanao; Davao Province, *Ramos* and *Edano,* 49575; Zamboanga District, *Ramos & Edano,* 36831, 37294; Misamis, Mt. Malindang, *Mearns & Hutchinson,* 4686; *Merrill,* 8293. Jolo, Sulu Province; *Vidal,* 2945; *Ramos & Edano,* 43925.

NETHERLANDS NEW GUINEA: 6 km. south-west of Bernhard Camp, Idenburg River, *Brass,* 12780. Angi, Arfak Mts., *Gibbs,* 5582 (type of *A. arfakensis*); *Kanehira & Hatusima,* 13737. Geiten Noord, *Versteeg,* 1442 (type of *M. amplifolia*).

PAPUA: Eastern Division; U-uma River, *Brass,* 1439 (type of *A. variaefolius*); Oroville Camp, Fly River, *Brass,* 7409. Central Division; Bella Vista, *Brass,* 5453. Western Division; Wuroi, Oriomo River, *Brass,* 5757. Boridi, *Carr,* 13270, 14608, 14627. Alola, *Carr,* 15001.

NEW GUINEA (Australian Mandate): Morobe District; Sattelburg, *Clemens,* 7820; Matap, *Clemens,* 11106; Orgeramnang, *Clemens,* 5427*a*; without precise locality, *Clemens,* 2419, 4570, 6266. Sepik, *Ledermann,* 6603.

SOLOMON ISLANDS: Bougainville; Kupei Gold Field, *Kajewski,* 1704; Marmaromino, *Kajewski,* 2202. Guadalcanal; Uulolo, Tutuve Mts., *Kajewski,* 2505.

EXCLUDED SPECIES

ANOMOPANAX CUMINGIANUS (C. Presl) Merrill in *Philipp. J. Sci.* **17:** 300 (1920).
Panax pinnatum Lam. *Encycl.* **2:** 715 (1788).
Panax secundum Schultes, *Syst.* **6:** 215 (1820), nomen illegit.
Paratropia cumingiana C. Presl, *Epim.* 250 (1851).

Nothopanax pinnatum (Lam.) Miq., *Bonplandia*, **4:** 139 (1856).
Nothopanax cumingii Seem., *Fl. Vit.*: 114 (1865).
Polyscias cumingiana (C. Presl) F. Vill. in Blanco, *Fl. Filip. Nov. App.* 102 (1880).
Panax cumingiana (Presl) Rolfe in *J. Linn. Soc. Lond. Bot.*, **21:** 310 (1884).
Polyscias rumphiana Harms, *Pflanzenfam.* **3,** 8: 45 (1898).
Polyscias sorongensis Gibbs, *Phytogeog. Arfak Mts.* 216 (1917).

This species was incorrectly attributed to *Anomopanax*. It differs from that genus in foliage characters, having truly pinnate leaves; in inflorescence characters, the primary branches being scattered on the rhachis; and in a very important floral character, having petals with broad insertions. It approaches the species of *Mackinlaya* in appearance because it has amplexicaul leaf-sheaths, articulated flowers, and two-locular ovaries, although this last character is not invariable, as it is in *Mackinlaya*.

The excluded species is clearly a member of the genus *Polyscias*; indeed, it agrees so closely with the type species of the genus (*P. pinnata* J. R. & G. Forst., a Polynesian species) that they might almost be conspecific. The Forsters' species, however, has more orbicular leaflets and a gynoecium of four carpels, compared with the two to three carpels of the species under discussion. In his treatment of *Polyscias* in *Die Nat. Pflanzenfamilien*, Harms accepted a statement by Baillon that the Forsters' specimen had seven carpels, and therefore failed to appreciate the relationship between the type species of the genus and the group of Malayan species that includes the present species (which he called *Polyscias rumphiana* Harms). This Malayan group of species corresponds to those placed by Seemann in *Nothopanax* (a genus erected by Miquel to include *Panax fruticosum* L. and some related species). Seemann did not refer these species to *Polyscias*, because he regarded the possession of a dimerous ovary of generic importance. As the characters shared by these plants include an amplexicaul leaf-sheath, articulated inflorescence branches, and free, tapering styles, it is clear that *Nothopanax* should be reduced to a synonym of *Polyscias*. It might be possible to restrict the name *Polyscias* to this small recognizable group of species, but the wide application now given to this generic name is perhaps justified in view of the considerable variation in the group as a whole. It is evident, however, that the current use of the generic name *Nothopanax* Miq. for certain Australasian and Chinese Araliaceous plants unrelated to the species originally included by Miquel is unjustifiable.

II. NEW SPECIES AND NEW RECORDS FROM NEW GUINEA AND THE SOLOMON ISLANDS

The collections obtained by the American expeditions to New Guinea under the leadership of Mr. Richard Archbold contained a considerable number of Araliaceous plants. These, together with other collections from New Guinea and the Solomon Islands, were kindly lent to me by the authorities of the Arnold Arboretum. Nineteen new species are described here, and three species are recorded from the area for the first time. *Aralia apoensis* Elmer, described from the Philippines, was collected at the extreme north-west of New Guinea by Kanehira and Hatusima; the Australian *Polyscias macgillivrayi* (Seem.) Harms was obtained by Brass in southern Papua;

and the Polynesian *Delarbrea collina* Viellot has been collected in the Solomon Islands by Brass and Waterhouse.

Plerandra micrantha Philipson, *sp. nov.*

Arbuscula usque ad 10 m. alta. *Folia* digitata, glabra; petiolus usque ad 24 cm. longus, vagina in appendicem intrapetiolarem 1·5 cm. longam producta; foliola c. 11; petiolulus c. 2 cm. longus; lamina obovata vel anguste elliptica, basi angustata, apice acuminata, margine undulata revoluta, 14×4·5 cm., costa subtus prominenti, nervis lateralibus multis parallelis. *Inflorescentia* terminalis; rhachis brevis, c. 1·5 cm. longa; ramuli primarii c. 12, 7–8 cm. longi; pedicelli c. 6 per umbellulam, c. 7 mm. longi. *Flores* virides, omnes ut videtur hermaphroditi, 6 mm. longi (ante anthesin). *Calyx* undulatus. *Petala* 5, 3 mm. longa. *Stamina* numerosa. *Ovarium* turbinatum, c. 8-loculare, c. 3×3 mm.; styli c. 8, breves. *Fructus* niger, 8×7 mm.

Solomon Islands: Guadalcanal; in stunted rain forest at 1,700 m., *S. F. Kajewsky*, 2619 (type in Arnold Arboretum, duplicate in British Museum).

The foliage is very similar to that of *P. solomonensis* Philipson, but the flowers are very much smaller and the inflorescence branches to the third degree.

Plerandra solomonensis Philipson, *sp. nov.*

Arbor erecta usque ad 33 m. alta, sparsim ramosa. *Folia* digitata, glabra; petiolus usque ad 30 cm. longus sed saepe brevior, vagina in appendicem intrapetiolarem 1 cm. longam producta; foliola c. 7; petiolulus 1–2 (–2·5) cm. longus; lamina obovata, basi attenuata, apice acuta vel subacuminata, margine undulata revoluta, usque ad 18×6 cm., costa subtus prominenti, nervis lateralibus obscuris. *Inflorescentia* subterminalis; rami primarii c. 5, crassi, usque ad 28 cm. longi; pedicelli c. 20 per umbellulam, 4 cm. longi. *Flores* omnes hermaphroditi vel exteriores masculi, c. 20 mm. longi (ante anthesin). *Calyx* undulatus. *Petala* 5, crassa, 1 cm. longa. *Stamina* numerosa. *Ovarium* turbinatum, c. 10-loculare, c. 10×7 mm.; styli c. 10, breves. *Fructus* ellipsoideus, 2·8×1·5 cm., obscure sulcatus, calyce persistenti, stylis obscuris.

Solomon Islands: Bougainville; Kupei Gold Field, 950 m., *S. F. Kajewsky*, 1653 (type in Arnold Arboretum, second sheet; duplicate in British Museum); Buin, Koniguru, 970 m., *S. F. Kajewsky*, 2053. Ysabel; Tiratona, *L. J. Brass*, 3320. Guadalcanal; Vulolo, Tutuve Mountain, *S. F. Kajewsky*, 2576.

This is at once distinguished from *P. brassii* Philipson and the New Guinea species (P. *stahliana*) by the much smaller leaflets, and the more numerous fruiting pedicels. From *P. micrantha*, which has similar foliage, it differs by its larger flowers and simple, not compound, umbelules. The field notes state that it is common in rain-forest and that the fruits are purple-black. Its native name on Ysabel is *Babaroana* and the sap is said to be used for relieving constipation.

Plerandra brassii Philipson, *sp. nov.*

Arbor usque ad 20 m. alta, sparsim ramosa. *Folia* digitata, glabra; petiolus usque ad 40 cm. longus, vagina in appendicem intrapetiolarem producta; foliola c. 7; petiolulus usque ad 5 cm. longus; lamina obovata, basi sensim attenuata, apice obtusa vel subacuminata, usque ad 30×12 cm., costa subtus prominenti, nervis

lateralibus utrinsecus 10–12, prominentibus. *Pedunculus* crassus, 20 cm. longus, c. 10- florus; pedicelli 4·5 cm. longi. *Flores* omnes ut videtur hermaphroditi. *Fructus* ovoideus, calyce styloque conico prominenti (stigmatibus 14) coronatus.

SOLOMON ISLANDS: San Cristoval; Star Harbour, *L. J. Brass*, 3105 (type in Arnold Arboretum).

This species has leaves approximately the same size as those of *P. stahliana* but the inflorescence and fruit are different. In *P. stahliana* the number of pedicels is much greater and the outer, male, flowers drop off as the fruits ripen. In *P. brassii* there are much fewer pedicels and none is shed. The fruit is also distinctive, having a persistent calyx and prominent style.

Tetraplasandra solomonensis Philipson, *sp. nov.*

Arbor erecta simplex, 3 m. alta. *Folia* imparipinnata, glabra, 80 cm. longa; petiolus teres, 20 cm. longus; rhachis nodosa; foliola 7–10 cm. longa; lamina oblongo-elliptica, basi inaequaliter angustata, apice acuminata, margine remote crenato-dentata, costa prominenti, nervis lateralibus visibilibus. *Inflorescentia* terminalis; rhachis crassa, 40 cm. longa; rami primarii 8–10 cm. longi; pedicelli c. 7 per umbellulam, 15–18 mm. longi (ad anthesin). *Flores* 8×5 mm. (ante anthesin), ad anthesin c. 15 mm. diam. *Calyx* undulatus. *Petala* c. 9, triangularia. *Stamina* numerosa. *Ovarium* compressum, 5×5 mm.; styli 7–13, ad centrum disci plani biseriatim dispositi.

SOLOMON ISLANDS: San Cristoval; Hinuahauro, in mountain rain-forest at 900 m., *L. J. Brass*, 2866 (type in Arnold Arboretum, first sheet).

The Solomon Islands lie between the two previously known centres of distribution of this genus, namely, Hawaii and the eastern Malayan islands. The species now described from San Cristoval resembles the Malayan members of the genus more closely than the Hawaiian. Its foliage is very similar to that of *T. paucidens* Miq., but the long branches and large flowers give its inflorescence a characteristic appearance. The three species described from the Malayan region (including the Philippines) may prove to be conspecific. I have examined the type gathering of *P. paucidens* Miq. and *P. philippinensis* Merrill, and conclude that the differences referred to in the original description of the latter species are due to the young state of the inflorescence. I have not seen the type of *T. koordersii* Harms, but as material gathered by Beccari in Celebes shows wide variation in the shape of the leaflets, the value of the lanceolate leaflet as a diagnostic character may be doubted.

Boerlagiodendron tricolor Philipson, *sp. nov.*

Frutex simplex usque ad 1·2 m. altus. *Folia* ampla, palmatiloba; petiolus c. 32 cm. longus, setulosus, basi cum crista spirali setosa, vagina in appendicem intrapetiolarem lanceolatam acutam ad 3 cm. longam producta; lamina 7-loba, margine serrata membranacea, subtus praesertim ad nervos puberula, tota 35 cm. longa, lobo medio 23 cm. longo, 10·5 cm. lato, basi attenuato, apice angustato. *Inflorescentia* terminalis, puberula; rhachis brevis; radii primarii c. 40–50, 3·5 cm. longi, apice in radiolos 3-partiti, radiolus intermedius c. 4 mm. longus, umbellulam florum sterilium ovoideorum apice puberulorum 3 mm. longorum gerens; radioli laterales 2·5–3 cm. longi, medio bibracteati, apice capitulum parvum bracteis fimbriatis gerentes. *Flores* c. 30

per capitulum, sessiles vel subsessiles, c. 3 mm. longi. *Calyx* brevissimus. *Petala* 5, 1·5 mm. longa. *Stamina* 5. *Ovarium* oblongum, 1·5 cm. longum, 5-loculare; styli 5, brevissimi.

NETHERLANDS NEW GUINEA: 15 km. south-west of Bernhard Camp, Idenburg River, in undergrowth of gulley in rain-forest at 1,500 m., *L. J. Brass*, 12394 (type in British Museum).

This is distinguished from other New Guinea species with sessile flowers and few ovary-loculi by its large, broadly lobed leaves with setulose petioles. The collector describes the inflorescence branches as purple, the fruits (i.e. the sterile flowers) as black, and the (fertile) flowers as orange.

Boerlagiodendron russellensis Philipson, *sp. nov.*

Frutex usque ad 3·5 m. altus, ramulis crassis. *Folia* ampla, palmatiloba; petiolus crassus, ut videtur 30 cm. vel ultra longus, basi cum crista spirali pectinata, vagina in appendicem intrapetiolarem amplissimam (c. 5 × 2·5 cm.) producta; lamina usque ad 60 cm. longa, basi cordata, profunde 5-loba; lobi elliptica, lobulati, apice acuti, margine serrati, basi sinubus latiusculis rotundatis sejuncti. *Flores* adhuc ignoti. *Infructescentia* terminalis, sparse furfuracea; rhachis brevis, crassa; radii primarii 12, c. 5 cm. longi; radii secundarii (fertiles) c. 5–6 cm. longi, prope basin articulati; pedicelli c. 7 per umbellulam, c. 10 mm. longi, apice dilatati. *Fructus* depresso-globosus, subcompressus, c. 9 × 11 mm., c. 14–locularis; styli c. 4, sessiles, ad centrum disci plani biseriatim dispositi.

SOLOMON ISLANDS: Russell Islands; in deep jungle, *R. T. Brice*, 18 (type in Arnold Arboretum).

This species would stand next to *B. pfeilii* (Warb.) Harms in the key to the New Guinea species published by Harms (*Engl. Jahrb.* **56**: 277 (1921)) because the flowers are pedicellate and the fruits have about fourteen loculi. It differs from the description of that species, however, in having the petiolar crest pectinate and the margins of the leaf-lobes regularly serrate. The primary rays are much shorter than those of *B. pfeilii*, and the fruits are broader than long. In the fresh condition the fruits are described as white, with the corolla scar and the stigmas red.

Meryta spathipedunculata Philipson, *sp. nov.*

Arbor usque ad 12 m. alta, ramulis glabris crassis. *Folia* simplicia, glabra; stipulae discoideae irregulariter lobatae; petiolus teres, c. 13 cm. longus; lamina obovata, basi attenuata, apice obtusa vel subemarginata, c. 30 × 12 cm., costa subtus prominenti, reticulo etiam conspicuo. *Flores* adhuc ignoti. *Infructescentia* terminalis; ramuli primarii c. 12, crassi, compressi, c. 11 cm. longi; ramuli secundarii 2, c. 14 cm. longi, prope basin articulati, apice expansi; receptaculum ovoideum, 1 cm. diam., fructibus c. 6. *Fructus* sessilis, globosus, 13 × 16 mm., 9-locularis; columna stylaris crassa, conica.

SOLOMON ISLANDS: Guadalcanal; Vulolo, Tutuve Mountain, common in rain-forest at 1,200 m., *S. F. Kajewski*, 2527 (type in British Museum).

This species is characterized by the long branches of the inflorescence which end in

expanded receptacles, each of which bears about six sessile fruits. Native name: *Targoie.*

Polyscias fraxinifolia Philipson, *sp. nov.*

Frutex simplex saepe epiphyticus, usque ad 1–2 m. altus, trunco gracili glabro. *Folia* imparipinnata, usque ad 34 cm. longa; petiolus usque ad 7 cm. longus; rhachis gracilis, articulata; petiolulus c. 4–7 mm. longus; lamina obovata vel elliptica vel anguste elliptica, basi angustata vel subrotundata, apice angustata vel subacuminata, margine minute setoso-crenata, costa prominenti, nervis lateralibus paucis, nervis tertiariis obscuris. *Inflorescentia* terminalis, corymbosa; rhachis brevis (1–2 cm.); rami primarii c. 4, subaequales, c. 3–4 cm. longi; rami secundarii subumbellati, usque ad 1 cm. longi; pedicelli umbellati, c. 6 per umbellulam, 4 mm. longi. *Flores* (ante anthesin) 3·5 mm. longi. *Calycis* lobi minuti, triangulares. *Petala* 5, triangularia. *Stamina* 5, filamento brevi, anthera rotundata. *Ovarium* turbinatum, c. 2×2 mm., 5-loculare; styli 5. *Fructus* adhuc ignotus.

NETHERLANDS NEW GUINEA: 15 km. south-west of Bernhard Camp, Idenburg River, *L. J. Brass*, 11874 (type in British Museum), 12112, and 12433; 18 km. south-west of Bernhard Camp, Idenburg River, *L. J. Brass*, 12633.

This species is not closely comparable with any other known New Guinea species of the genus. It is characterized by once-pinnate leaves, the leaflets dark green above and pale green below, and with setae on the tips of the crenations. The inflorescence is short and corymbose. The five styles are at first erect but become divergent in the young fruit. The specimen 12633 has a slightly different aspect to the other gatherings, perhaps due to the exposed situation in which it was growing. The species is said to be frequent in mossy forest at 1,800 m.

I have not seen authentic material of the three species of *Polyscias* which have their styles united (*P. schultzei* Harms, *P. gjelleruppii* Harms, and *P. caroli* Harms), but specimens which appear to agree with the descriptions of the first two of these species (*Clemens* 3742, 4514, and *Brass* 5409) seem better placed in *Kissodendron.* No doubt this genus is closely related to *Polyscias,* but it would appear preferable to keep this recognizable group of species distinct from the larger genus, especially as their geographical range is limited and continuous. *Kissodendron* would then comprise the three species named above, together with *K. bipinnatum* Gibbs and the type species, *K. australianum* F. Muell., which is known also from New Guinea (syn. *Panax zippelianum* Miq.).

Polyscias belensis Philipson, *sp. nov.*

Arbor usque ad 14 m. alta. *Folia* imparipinnata, usque ad 60 cm. longa; petiolus ad 12 cm. longus, supra late canaliculatus; rhachis articulata; foliola subsessilia vel petiolulis ad 1 cm. longis suffulta; lamina elliptica vel elliptico-lanceolata, basi angustata, apice obtusa, margine leviter revoluta, costa conspicua, nervis lateralibus utrinsecus c. 12. *Inflorescentia* terminalis; rhachis crassa, c. 18 cm. longa; rami primarii numerosi (c. 25) divaricati, ad 23 cm. longi, umbellulas racemosas gerentes; rami secundarii umbelluliferi c. 15 mm. longi; pedicelli c. 5 mm. longi. *Flores* (ante anthesin) c. 4 mm. longi. *Calyx* undulatus. *Petala* 4, oblonga. *Stamina* 4, filamento

brevissimo, anthera oblonga. *Ovarium* turbinatum, c. 2×1·5 mm., 4-loculare; styli 4. *Fructus* adhuc ignotus.

NETHERLANDS NEW GUINEA: Bele River, 18 km. north-east of Lake Habbema, 2,200 m. camp, *L. J. Brass* and *C. Versteegh* 11,112 (type in British Museum).

The inflorescence of this species is similar to that of *P. Forbesii* Baker fil., but the base of the leaflets is cuneate not truncate, the margin revolute and subentire not crenate, and the principal veins are fewer. It is said to be a rare tree in old secondary forest at 2,240 m. altitude. The tree was 14 m. high, and the trunk 35 cm. in diameter, with a small crown; the fairly smooth black bark is 7 mm. thick, and the wood soft and brown.

Polyscias macgillivrayi (Seem.) Harms.

Polyscias sp. C. T. White in *J. Arnold Arbor.* **10:** 255 (1929).

PAPUA: Domara River, *L. J. Brass*, 1606.

This provides another example of the close affinity between the floras of Papua and Queensland.

Schefflera (§ Cephaloschefflera) gigantea Philipson, *sp. nov.*

Arbuscula vel *frutex*. *Folia* digitata, glabra; petiolus crassiusculus, lenticellatus; foliola 9 vel ultra; petiolulus 6–11 cm. longus; lamina oblonga, basi rotundata, apice rotundata breviter acuminata, margine leviter revoluta undulata, 33×11 cm. vel ultra, coriacea. *Inflorescentiae* rhachis crassa, lenticellata; capitula pedicellata, racemosa, subglobosa, 3–4 cm. diam. (post anthesin), involucri bracteis 4 latissime rotundato-truncatis glabris, pedicello c. 2 cm. longo crassiusculo glabro. *Calycis* margo inconspicuus. *Corolla* adhuc ignota. *Staminum* cicatrices c. 20. *Ovarium* obconicum, sulcatum, c. 20-loculare; discus hemisphaericus, 5–7 mm. altus, c. 20-sulcatus; columna stylaris 1·5–2 mm. longa, 2 mm. crassa; stigmata c. 20, disciformia.

NEW GUINEA (Australian Mandate): Morobe District; Ogeramnang, 5,800 ft., *Clemens* 5386 (type in Arnold Arboretum); Auemburg, 2,000 ft., *Clemens* 2114.

This species is similar to *S. thamasiantha* Harms, but the pedicels of the capitula are longer and the style is distinctly columnar.

Schefflera (§ Cephaloschefflera) secunda Philipson, *sp. nov.*

Arbuscula vel *frutex*. *Folia* digitata, glabra; petiolus gracilis, levis; foliola c. 5; petiolulus c. 3 cm. longus; lamina obovata, basi cuneata, apice subacuminata acuta, 9–10×3·5–4 cm. *Rhachis* crassa, c. 40 cm. longa; capitula pedicellata, racemosa, secunda, c. 8-flora, 10 mm. diam. (ad anthesin), involucri bracteis 4, latissime rotundatis subfimbriatis. *Calycis* margo inconspicuus. *Corolla* conica vel subcylindrica, apice obtusa. *Stamina* 8. *Ovarium* conicum vel subcylindricum, late sulcatum, apice obtusum; stigmata sessilia.

NETHERLANDS NEW GUINEA: *Kanehira* and *Hatusima*, 14008 (type in Arnold Arboretum).

This species is related to *S. pullei* Harms and *S. corallinocarpa* Harms, but the long slender pedicels of the capitula, and other characters, do not agree with the descriptions of those species.

Schefflera (§ Cephaloschefflera) barbata Philipson, *sp. nov.*

Arbuscula usque ad 15 m. alta, ramulis crassis. *Folia* digitata; petiolus c. 25 cm. longus, glabrescens vel sparse stellato-tomentosus apice setulosus, vagina setosa in appendicem intrapetiolarem producta; foliola c. 16; petiolulus c. 3–6 cm. longus, glabrescens vel sparse stellato-tomentosus; lamina obovata, basi rotundata apice subacuminata obtusa, usque ad 12×4·3 cm., glabra. *Inflorescentia* terminalis; rhachis usque ad 26 cm. longa, dense setuloso-villosa; capitula pedicellata, racemosa, globosa, c. 12-flora, c. 5 mm. diam. (ad anthesin), densa, inter flores dense longe setulosa, pedicello 10–12 mm. longo setuloso-villoso (retrorse ad apicem), bracteis caducis basi setulosis. *Petala* et *stamina* adhuc ignota. *Ovarium* obconicum, angulatum, 5-loculare, disco subplano; stylus simplex c. 1 mm. longus.

PAPUA: Central Division; Murray Pass, Wharton Range, *L. J. Brass*, 4568 (type in Arnold Arboretum, Sheet I).

This species is closely related to *S. setulosa* Harms, but has larger leaves, more numerous glabrous leaflets, and smaller capitula.

Schefflera (§ Cephaloschefflera) hirsuta Philipson, *sp. nov.*

Arbuscula 5 m. alta, ramulis crassis setulosis. *Folia* digitata; petiolus c. 15 cm. longus, glabrescens; foliola 7; petiolulus 1–1·5 cm. longus, sparse stellato-tomentosus, basi setigerus; lamina obovata, basi obtusa, apice acuta appendiculata, margine superne profunde dentata, usque ad 12×4 cm., glabrescens vel sparse stellato-tomentosa. *Inflorescentia* terminalis; rhachis usque ad 33 cm. longa, dense setuloso-villosa; capitula pedicellata, racemosa, obovoidea, c. 10×7 mm., inter flores dense setulosa, pedicello c. 5 mm. longo, dense setuloso-villoso. *Petala* et *stamina* adhuc ignota. *Ovarium* obconicum, angulatum, 5-loculare, c. 2 mm. longum; stylus simplex, prominulus, c. 1·5 mm. longus.

NEW GUINEA (Australian Mandate): Morobe District; Sattelburg, 5,000–6,000 ft., *Clemens*, 7442 (type in Arnold Arboretum, duplicate in British Museum).

This species is distinguished from the other member of the section *Polyastrae* by the leaflets being toothed in their upper parts. The fur-like indumentum of the rhachis and pedicels, and the dense setae among the flowers are also noticeable.

Schefflera (§ Cephaloschefflera) reticulata Philipson, *sp. nov.*

Frutex epiphyticus, trunco simplici crasso dense ramentaceo. *Folia* digitata, glabra; petiolus usque ad 40 cm. longus, teres, levis; foliola c. 7; petiolulus usque ad 11 cm. longus; lamina oblongo-elliptica, basi late cuneata, apice angustata vel subrotundata, breviter acuminata, nervis reticuloque utrinque prominentibus vel prominulis (lamina media, sine acumine, 19–26×7–11 cm.). *Inflorescentia* terminalis, paniculata; rhachis 6–10 cm. longa, dense setosa et stellato-tomentosa; ramuli primarii 5–8, c. 12 cm. longi, stellato-tomentosi; capitula pedicellata racemosa, c. 8–10-flora, c. 5 mm. diam., minute involucrata bracteis setulosis, inter flores appendicibus linearibus setulosa, pedicello c. 3–4 mm. longo stellato-tomentoso. *Calycis* margo brevissimus. *Corolla* (in alabastro) subglobosa; petala 5. *Stamina* 5, filamento gracili, anthera parva rotundata. *Ovarium* obconicum, 5-loculare; discus planus; stigmata 5, subsessilia.

NETHERLANDS NEW GUINEA: 4 km. south-west of Bernhard Camp, Idenburg River, 850 m., *L. J. Brass*, 13404 (type in British Museum); 6 km. south-west of Bernhard Camp, 1,200 m., *L. J. Brass*, 12949.

This species is similar to *S. rudolfi* Harms but has larger leaflets with close reticulations and has shorter pedicels. The dense ramentum-like bristles at the ends of the branches are also distinctive.

Schefflera (§ Agalma) archboldiana Philipson, *sp. nov.*

Arbuscula usque ad 12 m. alta. *Folia* digitata; petiolus c. 10 cm. longus, vagina in appendicem brevem obtusam intrapetiolarem producta; foliola c. 7; petiolulus 2–3 cm. longus; lamina elliptica vel obovata, basi late cuneata, apice acuminata, margine leviter revoluta, c. 7·5 × 4 cm., coriacea, subtus stellato-tomentosa vel glabrescens. *Inflorescentia* terminalis, paniculata; rhachis c. 20 cm. longa, sparse stellato-tomentosa; ramuli primarii c. 12, 15 cm. longi, stellato-tomentosi; pedicelli c. 8-nati, 4–5 mm. longi (ad anthesin), stellato-tomentosi. *Calycis* margo brevissimus. *Corolla* (in alabastro) subglobosa, 1 mm. longa; petala c. 7. *Stamina* c. 7, filamento brevi, anthera rotundata. *Ovarium* obconicum, stellato-tomentosum, c. 7-loculare; stylus simplex, c. 1 mm. longus (ad anthesin). *Fructus* globosus, sulcatus, stylo prominenti c. 2 mm. longo.

NETHERLANDS NEW GUINEA: 15 km. south-west of Bernhard Camp, Idenburg River, 1,800 m., *L. J. Brass*, 11855 (type in British Museum).

Judging from the description, I conclude that this species is similar to *S. scytinophylla* Harms, but it has more numerous ovary-loculi, a longer finer style, and stellate hairs on the inflorescence.

Schefflera (§ Heptapleurum) nabirensis Philipson, *sp. nov.*

Frutex epiphyticus, ramulis crassis. *Folia* digitata, glabra; petiolus c. 40 cm. longus, teres, levis; foliola 7 (?); petiolulus c. 5 cm. longus; lamina anguste obovata vel lanceolato-oblonga, basi cuneata, apice acuminata, usque ad 16 × 5·5 cm. *Inflorescentia* terminalis, paniculata; rhachis brevis (c. 4 cm. longa), basin versus ramentis angustis brunneis dense vestita, supra furfuracea, bracteis lanceolatis furfuraceis c. 2 cm. longis; ramuli umbelliferi racemosi, graciles, glabrescentes, c. 17 mm. longi; pedicelli c. 15–20-nati, c. 7 mm. longi, graciles glabrescentes. *Calycis* margo brevissimus. *Corolla* (in alabastro) subglobosa, apice stellato-tomentosa; petala 5. *Stamina* 5, filamento brevi, anthera rotundata. *Ovarium* obconicum, 5-loculare, disco plano, stigmatibus 5 sessilibus.

NETHERLANDS NEW GUINEA: Dalman; Nabire, *R. Kanehira* and *S. Hatusima*, 12144 (type in Arnold Arboretum).

This species is similar to *S. bractescens* Ridley, but it has smaller leaves, a much shorter rhachis, and more delicate peduncles and pedicels. The panicle resembles that of *S. venulosa* (Wight & Arn.) Harms, except for the dense dark brown scales at the base of the rhachis

Schefflera (§ Heptapleurum) falcata Philipson, *sp. nov.*

Frutex 3–4 m. altus, ramulis crassis glabris. *Folia* digitata; petiolus crassus, glaber, vagina latissima glabra, ligula obtusa c. 2·5 cm. longa; foliola 5–7; petiolulus crassus, c. 1·5 cm. longus; lamina ovata, basi rotundata, apice obtusa, margine leviter revoluta, c. 12×6 cm., valde coriacea, supra nitida punctata, subtus tomento stellato-griseo dense vestita. *Inflorescentia* terminalis; rhachis crassa, c. 25–30 cm. longa, glabrescens vel sparse stellato-tomentosa; ramuli umbelliferi racemosi, c. 4–5 cm. longi, sparse stellato-tomentosi; pedicelli c. 18-nati, c. 10 mm. longi, stellato-tomentosi. *Calycis* margo minutus. *Corolla* calyptrata, obtusa, dense stellato-tomentosa; petala 6. *Stamina* 6, filamento basi expanso 2 mm. longo, anthera 1 mm. longa. *Ovarium* turbinatum, dense stellato-tomentosum, 5–6-loculare; discus conicus; stigmata subsessilia. *Fructus* (immaturus) subglobosus, 5–6-sulcatus, c. 1 cm. longus, disco prominenti.

NETHERLANDS NEW GUINEA: Mt. Wilhelmina; three miles east of top at 3,650 m., *L. J. Brass*, 9424 (type in British Museum); 4 km. north-east of top at 3,660 m., *L. J. Brass*, 9988.

This species is characterized by its leaves, which have very broad sheaths and ligules, and very stiff leathery leaflets which are described in the field-notes as concave, and which on drying have the two halves folded together and curved backwards. The exposed undersides are densely covered in grey stellate hairs. None of the descriptions published by Harms is sufficiently like it for a comparison to be drawn. The plant is said to be abundant in timber clumps.

Schefflera (§ Heptapleurum) babalia Philipson, *sp. nov.*

Arbor usque ad 20 m. alta. *Folia* digitata; petiolus usque ad 80 cm. longus, crassus, striatus, basin versus stellato-tomentosus, supra glabrescens, vagina squamata, ligula elongata obtusa; foliola c. 14; petiolulus usque ad 11 cm. longus, glaber vel prope basin sparse stellato-tomentosus; lamina oblongo-lanceolata, basi rotundata, apice breviter acuminata, margine revoluta, usque ad 38×11, subtus stellato-tomentosa. *Inflorescentia* terminalis, paniculata; rhachis 130 cm. longa, dense stellato-tomentosa et setosa, bracteis lanceolatis; ramuli primarii usque ad 90 cm. longi, dense stellato-tomentosi; ramuli umbelliferi racemosi, 1·2–1·5 cm. longi, dense stellato-tomentosi et setas fimbriatas gerentes; pedicelli 20–25-nati, c. 5 mm. longi, stellato-tomentosi, basi setis fimbriatis praediti. *Calycis* margo minutus, undulatus. *Petala* 5, oblonga, obtusa, c. 1·5 mm. longa, supra stellato-tomentosa. *Stamina* 5, filamento gracili c. 2 mm. longo, anthera rotundata c. 1 mm. longa. *Ovarium* obconicum, c. 1 mm. longum, 5-loculare, glabrescens; discus planus, sulcatus; stigmata 5, subsessilia.

SOLOMON ISLANDS: Ysabel; Tiratona, *L. J. Brass*, 3346 (type in Arnold Arboretum).

This plant occurs in rain-forest, usually on the banks of streams. Some of the measurements of the leaf and inflorescence incorporated in the description are taken from the collector's field-notes. The specific epithet is derived from the native name *babali*.

Arthrophyllum macranthum Philipson, *sp. nov.*

Arbor ramulis glabris. *Folia* imparipinnata vel superiora simplicia; petiolus c. 5–10 mm. longus; lamina (vel foliolorum vel foliorum simplicium) elliptica, usque ad 15×8 cm., basi anguste vel late cuneata, margine leviter revoluta. *Inflorescentia* terminalis vel axillaris; pedunculus c. 5 cm. longus; pedicelli ad 12 per umbellulam, 10–12 mm. longi. *Flores* (ante anthesin) 10–11 mm. longi. *Calyx* undulatus. *Petala* 4, triangularia. *Stamina* 4, filamento 3 mm. longo, anthera reniformi, 1·5 mm. longa. *Ovarium* turbinatum, c. 7×5 mm., 1-loculare; discus crassus; columna stylaris conica, crassa. *Fructus* adhuc ignotus.

NEW GUINEA (Australian Mandate): Morobe District; Boana, 200–230 m., *Clemens*, 8433 (type in Arnold Arboretum).

It is with some diffidence that I describe, on rather inadequate material, a new species of a genus so much in need of revision. The present species has foliage very similar to that of the only other species known from New Guinea, viz. the widely distributed *A. diversifolium* Bl., but it is at once distinguished from that species by the large size of its flowers. The type specimen bears several immature fruits. A single unopened flower-bud was detached and dissected. The parts were re-dried, and a drawing of the floral organs was attached to the type sheet.

Aralia apoensis Elmer.

NETHERLANDS NEW GUINEA: Arfak Mountains; Angi, *R. Kanehira* and *S. Hatusima*, 13682.

This is the first record of this genus from New Guinea. The specimen is a good match of the type gathering of Elmer's species from Mindanao. The most distinctive feature of this species is the fringe of brown hairs along each side of the principal nerves on the underside of the leaves. Otherwise it resembles *A. bipinnata* Blanco, another species from Mindanao, which has leaves of the same shape and colouring, but glabrous. The affinity of *A. apoensis* is clearly with this other Philippine species, and not with the Javan *A. dasyphylla* Miq., as suggested by Merrill in his *Enumeration of Philippine Plants*.

Delarbrea collina Viellot.

SOLOMON ISLANDS: San Cristoval; Waimamura, *L. J. Brass*, 2679.

This genus is centred in New Caledonia, with species known from Timor and New Guinea. The species now found in the Solomon Islands was originally described from the Loyalty Islands, but is known also from the New Hebrides. San Cristoval is the most southerly of the Solomons. A specimen of this species collected by Waterhouse on Bougainville Island is in the Kew Herbarium.

III. NOTES ON ASIATIC ARALIACEAE

1. *The identity of the Indian, Burmese, and Siamese* Dendropanax

A species of *Dendropanax* collected in the Khasia Hills by Hooker and Thompson and also by Griffith is identified by C. B. Clark in the *Flora of British India*, **2:** 733, 1879, as *Dendropanax japonicum* Seem. (= *Dendropanax trifidum* (Thunb.) Makino).

In 1924 Nakai showed that the Japanese species was not the same as that from the mainland of China, for which he proposed the name *Gilibertia sinensis* (he used the generic name *Gilibertia* for all the Asiatic species). In his revision of the Araliaceae of China, Hui Lin Li (*Sargentia*, **2**: 1, 1942) reduces Nakai's name to synonymy under *Dendropanax chevalieri* (Viguier) Merr., a species described from Indo-China in 1923. Meanwhile the material from the Khasia Hills has remained unidentified; Merrill in his list of the old-world species of *Dendropanax* (*Brittonia*, **4**: 131, 1941) omits reference to the *Flora of British India*, and India is not given as within the range of any species he lists. In the same paper Merrill describes a species from Burma, *D. burmanicus*. I have not seen the type of this species, but *Kingdon-Ward* 9279, which Merrill identifies with his own species, appears to be conspecific with the plants collected from the Khasia Hills. Merrill states that his species is related to *D. intercedens* (Hand.–Mazz.) Merr., but does not indicate how he considers it to differ from that species. In his paper on the Chinese Araliaceae, Li reduces *D. intercedens* to synonymy under *D. chevalieri* and suggests that a species described from Siam by Craib (Kew Bull. **1931**: 206) may also prove to be conspecific. Having examined additional material from Siam I am of the opinion that one species, with leaves of rather variable texture and form, extends from Siam through Indo-China to China, and through Burma to the Khasia Hills. *D. chevalieri* should therefore be added to the floras of India, Burma, and Siam, and the names *Gilibertia siamensis* Craib, *Dendropanax burmanicus* Merrill, and *Dendropanax japonicus* (non Seem.) C. B. Clarke be added to its synonymy.

2. *New species of* Brassaiopsis

Brassaiopsis karmalaica Philipson, *sp. nov.*

Arbor c. 13–16 m. alta. *Folia* petiolata, digitata, primum sparse stellato-tomentosa; petiolus c. 30 cm. longus, teres, glaber, vagina in appendicem intrapetiolarem obtusam c. 7 mm. longam protracta; foliola 7; petiolulus c. 10 mm. longus; lamina oblongo-oblanceolata, 23×4·5 cm., basi angustata, apice acuminata, margine apicem versus dentata, costa conspicua subtus prominenti, nervis lateralibus utrinsecus c. 10. *Inflorescentia* 22 cm. longa, umbellulis racemose dispositis; rhachis crassa, bracteis late ovatis usque ad 20 mm. longis praedita; ramuli simplices primum furfuracei, c. 4 cm. longi, basin versus bracteam parvam gerentes; umbellulae multiflorae, densae, 3–4 cm. diam., bracteis persistentibus; pedicelli 8 mm. longi, crassi, furfuracei. *Calycis* lobi triangulares, 1.5×2.5 mm. longi. *Petala* 5, triangularia, crassiuscula, c. 4 mm. longa. *Stamina* 5, 4–5 mm. longa. *Ovarium* obconicum, 2-loculare, 8×5 mm., furfuraceum; discus crassus, 5-sulcatus; columna stylaris 1·5 mm. longa, indivisa.

TIBET: Pome; Karma La, in the lower Po Tsangpo Valley, *Ludlow, Sheriff, and Elliot*, 12244 (type in British Museum (sheet 2)). Growing at 7,000 ft. in the wet forest zone.

This species appears to resemble *B. chengkangensis* Hu in the shape of its leaves and in its massive inflorescence, but it lacks the dense indementum of that species.

Brassaiopsis castaneifolia Philipson, *sp. nov.*

Frutex ramulis glabris. *Folia* simplicia, glabra; petiolus crassus, usque ad 13 mm. longus; lamina coriacea, oblanceolata, basi truncata, apice acuminata, margine spinescenti-dentata, costa subtus prominenti, nervis lateralibus utrinsecus c. 10 arcuato-adscendentibus. *Inflorescentia* paniculata, primum furfuracea, demum glabrescens; rhachis 25 cm. longa; rami primarii c. 8 cm. longi; rami secondarii umbelluliferi c. 2 cm. longi; umbellulae multiflorae; pedicelli ad anthesin 5 mm. longi, in fructu c. 12 mm. longi. *Calycis* lobi 5, minuti. *Petala* 5, triangularia, 3×2 mm. *Stamina* 5, filamento 4 mm. longo, anthera 1 mm. longa. *Ovarium* obconicum, 2-loculare; discus planus, sulcatus; columna stylaris indivisa, in fructu elongata (3 mm.).

BURMA: Lat. 27°35′ N., long. 97°50′ E., 3,000–4,000 ft., *F. Kingdon-Ward*, 13537 (type in British Museum).

This species of *Brassaiopsis* may be compared with *B. simplicifolia* C. B. Clarke, which also has simple leaves. In that species, however, the petiole is much longer and the lamina is broadest near the base.

AN UNDESCRIBED SPECIES OF *MASTICHODENDRON* (SAPOTACEAE) FROM BARBADOS AND ANTIGUA

By H. E. BOX *and* W. R. PHILIPSON

(*With Plate* 1)

In 1937 one of us (H.E.B.) collected a specimen of a Sapotaceous tree in Antigua which was evidently a species of *Mastichodendron*. The specimen consists of leafy twigs, together with seeds picked up beneath the tree, which is the only known example of the species in the island. The specimen could not be matched with any described species in this or any related genus, but it resembles three specimens in the Sloane Herbarium, preserved in the Department of Botany of the British Museum, which were collected in the late seventeenth century. One of these early specimens was collected by Sloane in Barbados in 1687 (*Herb. Sloane*, vol. 7, fol. 62) and seeds are preserved separately in Sloane's collection of seeds and fruits (items No. 1430 and 1593, mixed in one box; a third specimen of the fruits, catalogued as No. 9275, cannot be traced). A second specimen (*Herb. Sloane*, vol. 184, fol. 54) was collected in Barbados by James Reed in, or before, 1692. The third specimen, which in some ways is the best preserved, fruit and seed being mounted with a leafy twig, was in Plukenet's Herbarium before it was acquired by Sloane. Unfortunately Plukenet did not record the collector or place of origin of the specimen.

Except for misidentifications with *Mastichodendron foetidissimum* no binomial appears to have been applied to this plant, and though mentioned in several pre-Linnean works it has been lost sight of until re-collected in Antigua in 1937.

The first certain reference to the tree in botanical literature was by Plukenet in 1691, when he figured the specimen in his own herbarium (*Phytograph.*, tab. 217, fig. 5) with the name *Prunifera vel nucifera seu nuci-prunifera arbor Americana praecelsa, angustis laurifoliis, laete virentibus. Mastichen odoratum fundens.* In his *Almagestum Botanicum* (1796) he referred to it as the 'Masticke Tree'; this name with or without the Latin phrase name was taken up by Sloane (*Cat. Pl. Jam.*: 180 (1696) and *Nat. Hist. Jam.*: 40 (1707)), by Ray (*Hist. Pl.*: 42 (1704)), and by Petiver in *Petiveriana*: 3 (1716). Sloane gave the following first-hand account of the tree in *Nat. Hist. Jam.*: 40.

> 'This is one of the largest trees, and highest of the Island of Barbados, where it grows every where, and is in use for all sorts of buildings. The twigs were brown and smooth, having leaves with very short, if any foot-stalks, being themselves about three inches long and about an inch broad in the middle where broadest, and whence it decreases to both extremes, being of a very curious green colour, smooth and shining, somewhat like to Bay-leaves, having one middle, and several transverse nerves running very curiously through the leaf, which is hard and not succulent. The fruit was a turbinated small plum of the bigness and shape of a Hazel-nut, having

under a membrane of thin pulp, covering a very large and smooth stone, which is hard, and includes a white kernel. It grew every where in the Island of Barbados.'

Both Sloane and Plukenet attempted to identify this Mastic tree of Barbados with trees mentioned by earlier travellers. Plukenet's references to Garcia and Acosta are evidently mistaken, these referring to a species of *Eugenia* (see Markham's translation of Garcia da Orta, *Simples and Drugs of India* (1913)). The reference to the 'Masticke' tree in John Smith's *Travels and Observations* (1630: 55) relates to the island of St. Christopher and probably to the more widely spread *Mastichodendron foetidissima* (Jacq.) H. J. Lam.[1] We are unable to interpret de Laet's reference to Mastyche (*Americae utrisque descriptio*, lib. 15, cap. 8, p. 560, 1633) and no indication of locality is given. Ligon (*True and Exact Account of the Island of Barbados*, 1657) gives a first-hand account of the 'Mastick Tree' (pp. 14 and 73), but his description cannot be linked certainly with the tree described and collected by Sloane. As he himself admits, his account of the fruit is puzzling, but it agrees with the apparently independent description by Hughes (*Nat. Hist. Barbados*, 1750: 149). The two descriptions suggest that the tree may have been subject to attack by a gall-forming insect or a witches-broom fungus.

An account of the transference of the name Mastic from certain old-world gum-bearing trees to trees in the new world with similar properties is given in the *New English Dictionary* (Oxford, 1908).

One hundred and forty-three years after Sloane described the abundance of the tree, Maycock in his *Flora Barbadensis* (1830) wrongly identified the tree with *Sideroxylon mastichodendron* Jacq. (a synonym of *Mastichodendron foetidissimum*) and stated that 'this valuable timber tree which was once so common in Barbados, is now very rarely to be seen'.

Schomburgk (*History of Barbados*, 1847) referred to the 'Mastick tree' as *Bumelia Mastichodendrum* Roem. & Schult. F. Hardy, writing in 1932 (*Agric. J., Barbados* 1 (3): 40), referred to 'an occasional specimen of Mastic (*Bumelia Mastichodendron* (?)) in Foster-Hall Wood, St. Joseph Parish, Barbados'.

In reply to an inquiry, Dr. A. E. S. McIntosh, Assistant Director of Agriculture, Barbados, wrote under date 10 May 1939:

> 'In my plant collecting for the local Museum I have not come across any species of the genus (*Sideroxylon*) although I am aware of Hardy's reference to the ''Mastic'' tree as growing in the eastern part of Upper Foster Hall Wood. It is probable, however, that there may still be one or two isolated trees, although it is curious that in the herbarium of our Department made by the late Mr. J. R. Bovell, there are no sheets of *Sideroxylon* or its synonymous genera.'

The species is not represented in the Kew Herbarium, nor does it appear to be known in the U.S. National Herbarium at Washington. So far as we have been able to ascertain the only specimens known are those from Barbados in Sloane's Herbarium and the recent specimen from Antigua. The available evidence suggests that this species was endemic in Barbados, and by its absence from any of the intervening islands it may be concluded that it was introduced there from Barbados about 1695 when many settlers from Barbados arrived in Antigua under Sir Christopher Codrington. The tree, which is the only one known on the island, was growing in second-growth mesophytic woodlands in a ravine above Dark Valley, on the western slopes of Boggy Peak, at an altitude of about 350 feet.

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[1] We attribute this combination to Lam and not Cronquist (see *Lloydia*, **9**: 244, 1946); Lam's use of the generic name *Mastichodendron* was valid as the group which he raised to generic rank (*Med. Bot. Mus. Rijks univ. Utrecht*, **65**: 521, 1939) had, in fact, been described by Engler (*Pflanzenfam.* **4** (i): 144, 1891) as a section *Mastichodendron* of *Sideroxylon*.

The material available is insufficient for a full description, but as additional material is not likely to come to hand, and as it is essential to have a name by which to refer to this once well-known and important tree, we append the following description.

Mastichodendron sloaneanum Box & Philipson, *sp. nov.*

Sideroxylon mastichodendron (non Jacq.) Maycock, *Fl. Barbad.*: iii (1830).
Bumelia mastichodendrum (non Roem. & Schult.) Schomburgk, *Hist. Barbad.*: 609 (1847).

Arbor alta ramulis novis et gemmis aureo-pubescentibus. *Folia* alterna glabra; petiolus brevis canaliculatus 5–12 mm. longus; lamina oblanceolata, basi attenuata, apice acuminata obtusa, c. 13×3·5(5) cm., margine crispa, costa conspicua subtus prominenti, nervis lateralibus utrinsecus c. 12. *Flores* adhuc ignoti. *Fructus* c. 20×15 mm. *Semen* oblongo-ellipsoideum vel obovoideum subcompressum; cicatrix basilateralis c. 5–6×4–5 mm., infra areolam elevatam obovatam sulco longitudinali percursam posita.

BARBADOS: Sloane, 1687. Type in *Herb. Mus. Brit.* (twigs in *Herb. Sloane*, vol. 7, fol. 62; fruits in Sloane Col. No. 1430 and 1593). Reed, *c.* 1692 (*Herb. Sloane*, vol. 184, fol. 54). Specimen in Plukenet's Herbarium, probably from Barbados in seventeenth century (*Herb. Sloane*, vol. 97, fol. 126).

ANTIGUA: Box, 809: Dark Valley below Boggy Peak, May 1937.

This species differs from *M. foetidissimum* (Jacq.) H. J. Lam by the shorter, thicker petiole and the more lanceolate leaf-blade, which tapers more gradually into the petiole than is typical of *M. foetidissimum*. The material collected in Antigua has slightly broader leaves and longer petioles than the Barbados gatherings, but appears conspecific with them.

BRITISH MUSEUM NATURAL HISTORY

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PLATE I

(*a*) Type specimen of *Mastichodendron sloaneanum* Box & Philipson, *Herb. Sloane*, vol. 7, fol. 62.

(*b*) Seed of *M. sloaneanum* in Sloane's collection of fruits.

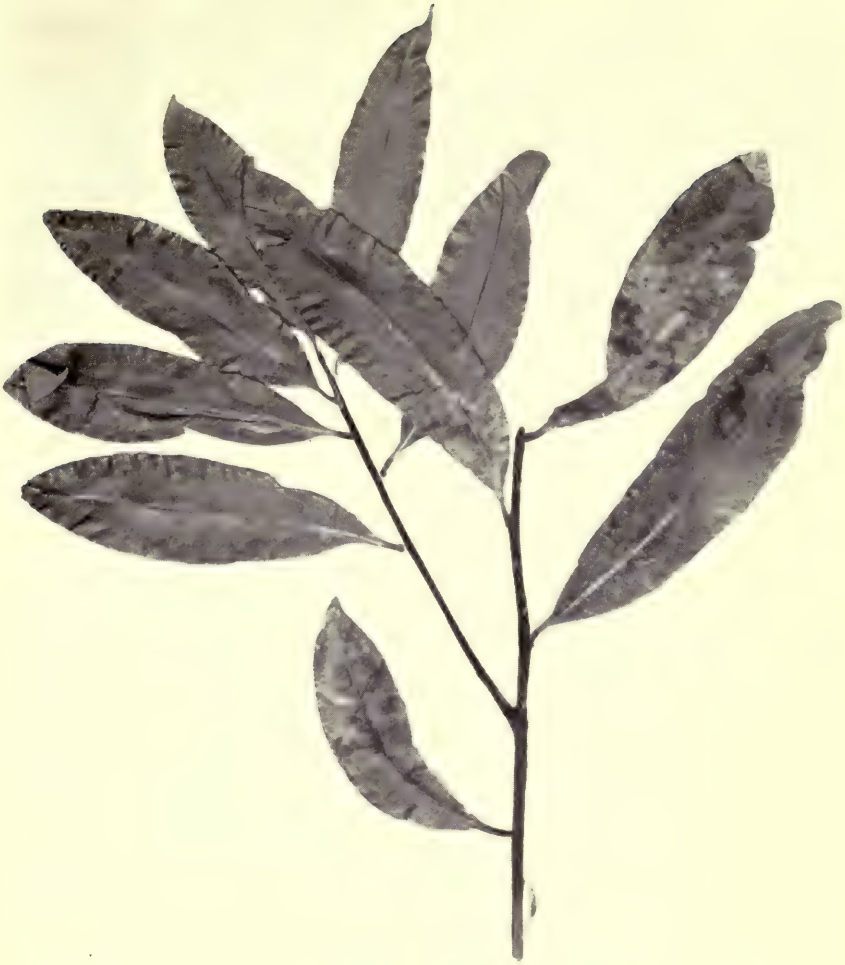

FIG. 1. Type Specimen of *Mastichodendron sloaneanum* Box & Philipson

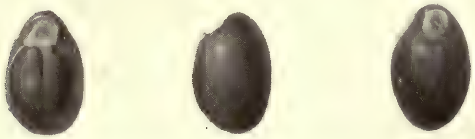

FIG. 2. Seeds of *Mastichodendron sloaneanum* (nat. size)

BRITISH MUSEUM NATURAL HISTORY
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A REVISION OF THE WEST INDIAN SPECIES OF *SELAGINELLA*

A NEW SPECIES OF *CHEILANTHES* FROM AFRICA AND SOME ADDITIONS TO THE FERN FLORA OF NORTHERN RHODESIA

A. H. G. ALSTON

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A REVISION OF THE WEST INDIAN SPECIES OF *SELAGINELLA*

By A. H. G. ALSTON

No revision of the West Indian species of *Selaginella* with a key has ever been published, and this work has, as might be expected, involved a great reduction in the number of species recognized. Twenty-seven species are now recognized as native to the islands, though one (*S. umbrosa*) is possibly an introduction. Trinidad and Tobago are excluded from this account as the species found there have already been dealt with in a separate paper (*Journ. of Bot.* lxxii: 33–40 (1934)). Barbados is, like Trinidad and Tobago, part of the South American continental shelf and is not genetically connected with the Lesser Antilles. It became elevated above sea-level in the Pliocene or early Pleistocene. Trinidad was then connected with northern Venezuela but probably not with Barbados. Barbados has only one *Selaginella*, which is a species also found in Tobago but not in Trinidad or Venezuela.

The Lesser Antilles fall into two groups geologically. Firstly there is an older, north-eastern series of volcanic islands with limestone tops. These are mostly comparatively small, dry islands from which no species of *Selaginella* has been reported. The low flat eastern half of Guadeloupe, known as Grande Terre, also belongs to this series. Secondly there is a younger series of islands (Saba to Grenada) consisting of volcanoes, separated from the Antillean geanticline, on which the Virgin Islands are situated, by the deep Anegada passage. The Virgin Islands are thought to have been united with Puerto Rico as recently as the Pleistocene. Two species of *Selaginella*, *S. flabellata* (L.) Spring and *S. rotundifolia* Spring, are confined to the Lesser Antilles and both have been collected from most of them. Both these species are found in Grenada, but the Tobago species *S. umbrosa* Lemaire ex Hieron., *S. flagellata* Spring, *S. trifurcata* Bak. and *S. producta* Bak. are none of them found in Grenada. *S. flabellata* closely resembles a widespread Andean and Central American species—*S. anceps* C. Presl. The affinity of *S. rotundifolia* is less obvious, but it resembles both *S. ovifolia* Bak. from the Greater Antilles and *S. microdonta* A. C. Sm. from Mt. Duida, Venezuela.

The islands of Puerto Rico, Hispaniola and Jamaica are thought to have formed a single land-mass connected with Honduras in the early Pliocene (Schuchert:[1] 437) and have subsequently been variously united and fragmented, but never completely submerged (*op. cit.*: 709). Cuba seems not to have been directly united with these islands since the Lower Oligocene (*op. cit.*: t. 11), and has remained completely severed from the mainland since the Middle Oligocene (*op. cit.*: t. 12). There is one species confined to British Honduras and these three islands which is not also found in Cuba—*S. ovifolia*. *S. plumosa* (L.) C. Presl extends from Cuba through the Greater Antilles to St. Thomas in the Virgin Islands, and *S. substipitata* Spring, which is found in the

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[1] C. Schuchert. *Historical Geology of the Antillean-Caribbean Region.* New York, 1935.

Lesser Antilles and Trinidad, extends to Puerto Rico and Hispaniola but has not been found in Jamaica or Cuba. *S. krugii* Hieron. is endemic in Puerto Rico and *S. laxifolia* Bak. ex Krug represents *S. confusa* Spring there. Hispaniola has one endemic which is very distinct among the West Indian species—*S. fuertesii* Hieron.—and *S. flabellum* (Desv.) Spring, apparently representing *S. subcaulescens* Bak. *S. denudata* (Willd.) Spring is endemic in Jamaica and *S. hispida* (Willd.) A. Braun ex Urb. represents *S. plagiochila* Bak. Hispaniola and Jamaica perhaps share *S. leonardi* O. C. Schmidt.

The more isolated geological history of Cuba is not strongly reflected in the *Selaginella* flora. There are two endemics, *S. pauciciliata* Hieron. and *S. prasina* Bak., while *S. bracei* Hieron. ex O. C. Schmidt is found in Cuba and the Bahamas. Two mainland species, *S. convoluta* (Arn.) Spring and *S. microdendron* Bak., reach Cuba, but the former is also found in Hispaniola and the latter in Jamaica. Cuba and Hispaniola also share *S. plumieri* Hieron. and *S. plagiochila*, while Cuba, Jamaica and Hispaniola have *S. heterodonta* (Desv.) Hieron. in common. *S. subcaulescens* is found in Cuba, Jamaica and Puerto Rico, but is represented by *S. flabellum* in Hispaniola. Cuba and Jamaica have *S. confusa*. Puerto Rico, which is 450 miles from Cuba, has five species common to Cuba, though the two islands do not appear to have been united since the Lower Oligocene (*op. cit.*: t. 11); it has a distinctly poorer *Selaginella* flora than the other large islands. The only generally distributed species is *S. tenella* (Beauv.) Spring. *S. serpens* (Desv.) Spring is also found in both Greater and Lesser Antilles. The Bermudas, which probably originated in the late Cretaceous (*op. cit.*: 738) and covered about 230 square miles in the Pleistocene, have no native species of *Selaginella*.

It is evident that the 80 miles of sea separating Tobago from Grenada, and the 120 miles which separate St. Thomas from Saba, are much more formidable barriers to *Selaginella* than the 90 miles between Cuba and Jamaica, and there seems to be no reason for this but the geological history of the various islands.

This account has been based on the Museum collection (BM), a loan of the fine collection of the New York Botanical Garden (NY), supplemented by additional records from Kew (K), Gray Herbarium, Harvard (Gray), Leyden (Ley), Washington (US), Oxford (Ox), Paris (P) and Geneva (G). The author wishes to express his indebtedness for the loan of this valuable material.

Key to the Species

Leaves uniform, spirally arranged (group of *S. rupestris*) 1. *pauciciliata*
Leaves dimorphous:
  Main stems usually with flagelliform apices:
    Median leaves oblong-ovate, acuminate; lateral leaves rounded at base . . . . . . 20. *heterodonta*
    Median leaves ovate, aristate; lateral leaves cordate at base . . . . 19. *cordifolia*
  Main stems without flagelliform apices:
    Main stems erect or suberect, rooting at base only:
      Erect stems red (Barbados) . . . . 2. *umbrosa*
      Erect stems not red:

Stems blackish; leaves subcoriaceous . . 3. *convoluta*
Stems straw-coloured, buff or greenish; leaves membranaceous:
Leaves of erect stems uniform, adpressed, directed upwards:
Axillary leaves ovate; light green; stems (+leaves) up to 2 mm. across (Cuba and Jamaica) . . . . 4. *microdendron*
Axillary leaves oblong-lanceolate; dark green; stems (+leaves) up to 4 mm. across (Lesser Antilles) . . . 5. *flabellata*
Leaves of erect stems spreading and dimorphous, at least in the upper part:
Lateral leaves ovate:
Plants 3–15 cm. high; microspores with sessile papillae on the distal surface (Cuba and Jamaica) . . . 6. *confusa*
Plants 7–30 cm. high; microspores with stalked papillae on the distal surface (Puerto Rico) . . . . . 7. *laxifolia*
Lateral leaves oblong:
Lateral leaves usually ciliate, somewhat decrescent at unbranched base of stem; rhizophores filiform:
Median leaves auriculate . . . 8. *flabellum*
Median leaves exauriculate . . 9. *subcaulescens*
Lateral leaves denticulate; leaves dimorphous; stem branched to base; rhizophores straight and stout . 10. *substipitata*
Stems prostrate and rooting throughout:
Rhizophores dorsal, extra-axillary; stems articulate:
Axillary leaves auriculate . . . . . 11. *plumosa*
Axillary leaves exauriculate . . . . 12. *fuertesii*
Rhizophores ventral, axillary; stems not articulate:
Stems rather stout, about 1 mm. in diam.:
Lateral leaves ovate, subacute:
Lateral leaves ciliate; median leaves acuminate or shortly aristate . . . 13. *leonardi*
Lateral leaves denticulate; arista of median leaves more than half length of lamina:
Sporophylls dimorphous . . . 14. *plumieri*
Sporophylls not dimorphous . . . 15. *krugii*
Lateral leaves oblong, rounded at apex, denticulate; sporophylls not dimorphous . . 16. *denudata*

Stems filiform, less than 0·5 mm. in diam.:
Leaves hairy on the upper surface:
Median leaves auriculate, more than half as long as lateral leaves; lateral leaves with stiff texture, remaining flat (Jamaica) . 17. *hispida*
Median leaves exauriculate, less than half as long as lateral leaves; lateral leaves with delicate texture, sometimes with margin inrolled (Cuba, I. of Pines, Hispaniola) . 18. *plagiochila*
Leaves glabrous on both surfaces:
Median leaves auriculate:
Lateral leaves subacute . . . 20. *heterodonta*
Lateral leaves obtuse. . . . 21. *serpens*
Median leaves exauriculate:
Median leaves subacute, ovate; lateral leaves denticulate . . . . 22. *prasina*
Median leaves acute to aristate:
Lateral leaves ovate-oblong:
Arista of median leaves more than half as long as lamina; median leaves ovate; lateral leaves denticulate . . . . . 23. *tenella*
Arista of median leaves less than half as long as lamina; median leaves ovate-lanceolate:
Median and lateral leaves strongly ciliate . . . . . 24. *armata*
Median and lateral leaves denticulate or ciliolate . . . 25. *bracei*
Lateral leaves broadly elliptic:
Lateral leaves denticulate . . 26. *rotundifolia*
Lateral leaves ciliate . . . 27. *ovifolia*

1. **Selaginella pauciciliata** Hieron. in Hedwigia lviii: 284 (1917).

Selaginella rupestris sensu Griseb., Cat. Pl. Cub.: 271 (1866); non Spring.—Sauvalle in An. Acad. Habana viii: 413 (1872).

CUBA. Without precise locality, *Wright 1820* (syntype-collection; BM); bare rocky places in woods, Holguin, Oriente, *Wright 20* (syntype-collection; NY).

Geographical range: endemic in eastern Cuba.

2. **Selaginella umbrosa** [Regel, Gartenflora iv: 314 (1855), *nom. nud.*] Lemaire ex Hieron. in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 683, fig. 404 (1901).

Lycopodium umbrosum Lemaire ex Kunze in Linnaea xxiii: 292 (1850), *nom. synon.*; non *L. umbrosum* Bory ex Willd. (1810).
Selaginella erythropus sensu Jenman, Ferns Brit. W. Ind.: 401 (1909); non Spring.
Selaginella lemairei Hieron. in Hedwigia lviii: 287 (1917), *nom. illegit.*

BARBADOS. Caves and gullies, St. John's Parish, *Jenman* (K; NY).

Geographical range: Yucatan and British Honduras to Colombia; Barbados and Tobago.

This species is common in cultivation, and possibly it is an introduction in Barbados and Tobago. It appears, however, to be quite common in the latter island, as several collectors have gathered it there.

3. **Selaginella convoluta** (Arn.) Spring in Mart., Fl. Brasil. i, 2: 131 (1840).—Griseb., Cat. Pl. Cub.: 271 (1866).

Lycopodium convolutum Arn. in Mem. Werner. Nat. Hist. Soc. v: 199 (1824); in Mém. Soc. Hist. Nat. Par. i: 347 (1824).

Selaginella lepidophylla sensu Sauvalle in An. Acad. Habana viii: 413 (1872); non Spring.

Selaginella longispicata Underw. apud Millsp. in Publ. Field Columb. Mus., Bot. Ser. i: 287, t. 10 (1896).

Selaginella longispicata var. *subintegrifolia* Hieron. in Hedwigia lviii: 286 (1917).

CUBA. Without precise locality, *Wright 938 pro parte* (NY); Gamboa, Oriente, *Ekman 14951* (BM; NY).

HISPANIOLA. Rio Mao, Monción, Prov. Monte Cristi, *c.* 200 m., *Ekman 12607* (K); ravines, Mao, Prov. Santiago, 1–300 m., *Abbott 1035* (NY); near Mao Adentro, Valle del Cibao, Prov. Santiago, *c.* 100 m., *Ekman 13101* (K).

Geographical range: Yucatan, Guatemala, Cuba and Hispaniola, south to Paraguay and Bolivia.

4. **Selaginella microdendron** Bak. in Journ. of Bot. xxiii: 116 (1885); Handb. Fern-Allies: 100 (1887).—Hieron. in Hedwigia lviii: 285 (1917).

Selaginella sulcangula sensu Spring in Mém. Acad. R. Belg. xxiv: 163 (1850) pro parte, quoad pl. jamaic.; non Spring sensu orig.—Fée, Mém. Fam. Foug. xi: 134 (1866).

Selaginella cuspidata sensu Griseb., Fl. Brit. W. Ind. Is.: 645 (1864); non Link.—Sauvalle in An. Acad. Habana viii: 413 (1872).—Jenman, Ferns Brit. W. Ind.: 402 (1909).—Hieron., tom. cit.: 286 (1917).

Selaginella harrisii Underw. & Hieron. apud Hieron. in Urb., Symb. Antill. vii: 162 (1912).

CUBA. *Wright 938 pro parte* (ex Hieron.), *3910* (BM; K, type).

JAMAICA. Without precise locality, *Purdie* (BM), *Wilson* (BM), *Jenman* (NY); Whitfield Hall, 900 m., *Harris 7587* (BM; NY), *Underwood 2480* (NY), *2508* (NY), *Miss Taylor* (K), *Harris* (K); Green River Valley, *Underwood 1520* (NY); 'Old England', below Cinchona, *Underwood 1633* (NY); Farm Hill Works, *Orcutt 5184* (K; NY); Farm Hill, *Orcutt 3603* (BM; K); banks of Negro R., Blue Mts., *Purdie* (K).

Geographical range: south-eastern Mexico, British Honduras, Cuba and Jamaica.

The type-collection, *Wright 3910* from Cuba, appears to represent a slender state of the species.

5. **Selaginella flabellata** (L.) Spring in Flora xxi: 198 (1838); in Bull. Acad. Brux. x, 1: 225 (1843).—Griseb., Fl. Brit. W. Ind. Is.: 646 (1864).—Fée, Mém. Fam. Foug. xi: 134 (1866).—Husnot, Cat. Crypt. Antill. Franç.: 58 (1870).—Krug apud Urb. in Engl., Bot. Jahrb. xxiv: 151 (1897).—Duss, Fl. Crypt. Antill. Franç.: 128

(1904).—Jenman, Ferns Brit. W. Ind.: 402 (1909).—Boldingh, Fl. Dutch W. Ind.: 11 (1909).—Hieron. in Hedwigia lviii: 289 (1917).

Muscus squammosus, erectus Plum., Descr. Pl. Amer.: 35, t. 24 fig. a (1693): Traité des Fougères: t. 43 (1705).
Muscus squamosus, ramosissimus, erectus Plum., Nov. Pl. Amer., Cat.: 16 (1703).
Lycopodioides dentatum erectum filicinum, caule tereti ramosissimo Dillen., Hist. Musc.: 468, t. 65 fig. 5 (1741).
Trispermium erectum spicis triangularibus Hill, Gen. Nat. Hist. ii: 113 (1751).
Lycopodium flabellatum L., Sp. Pl. ii: 1105 (1753).
Selaginella flabellata var. *laxa* A. Braun in Ann. Sci. Nat., Sér. 5, Bot. iii: 278 (1865).
Lycopodioides flabellatum (L.) Kuntze, Revis. Gen. Pl. ii: 824 (1891).
Selaginella flabellatiformis Hieron., tom. cit.: 293 (1917).

St. Thomas. *Eggers 488* (ex Krug).

Saba. *Boldingh 1778 aB* and *2206 aB* (ex Boldingh and Hieron.).

St. Kitts. Without precise locality, *Masson* (BM), *Rodger 15* (BM), *16* (BM), *21* (BM), *23* (BM), *25* (BM); slopes of Mt. Misery, 400–750 m., *Box 258* (BM), *Rodger 9* (BM), *10* (BM), *13* (BM), *14* (BM), *19* (BM).

Nevis. Mt. Nevis, *Rodger 31* (BM), *32* (BM), *33* (BM), *34* (BM), *37* (BM), *38* (BM), *40* (BM), *41* (BM), *43* (BM), *44* (BM), *45* (BM).

Montserrat. Souffriere neighbourhood, 240–360 m., *Torlesse & Mansell* (BM); woods near Chance's Pond, 820 m., *Howard 11903* (BM).

Guadeloupe. *L'Herminier* (BM).

Dominica. Without precise locality, *Rodger 46* (BM), *47* (BM), *Fothergill* (BM); Providence, 540 m., *Gregory* (BM); Roseau, *Crawford* (BM); Laudat, *Ramage* (BM); waterfalls of Massacre R., between Sylvania and Mt. Joy, 500 m., *Hodge 1368* (BM).

Martinique. *Kohaut* in *Sieber, Fl. mixta 323* (BM), *von Rohr 130* (BM).

St. Lucia. Roseau-Milette Ridge, 480 m., *Box 509* (BM); source of Canaries R., *c.* 600 m., *Box 457* (BM); Upper Roseau R., 330 m., *Box 467* (BM); Ravine Poisson, 60–180 m., *Box 424* (BM); woods along Soufriere–Fond St. Jacques road, *Howard 11573* (BM).

St. Vincent. *Caley* (BM), *Smith 119* (BM).

Grenada. Without precise locality, *Sherring 23* (BM), *98* (BM); St. Georges-Etang road, 300–600 m., *Totton & Gracie* (BM); woods south of the Grand Etang, *Howard 10673* (BM).

Geographical range: confined to the Lesser Antilles.

S. flabellatiformis Hieron. seems to be only a state induced by cultivation in greenhouses. Hieronymus gave the locality as 'vielleicht aus Borneo', but no species like this is known from Borneo.

Fée reported *S. flabellata* as collected in Jamaica by de Tussac, but it hardly seems possible that so conspicuous a species can have been overlooked by all subsequent collectors and a mistake is likely. Krug's record from St. Thomas is not mentioned by Maxon in *Scientific Survey of Porto Rico and the Virgin Islands* vi (1926) and may also be an error.

Baker and other authors have placed under *S. flabellata* many species which are now separated. Specimens labelled *S. flabellata* from Trinidad are mostly *S. hartii* Hieron. and those from Central and South America largely *S. anceps* C. Presl.

6. **Selaginella confusa** Spring in Flora xxi: 218 (1838); in Bull. Acad. Brux. x, 1: 140 (1843); in Mém. Acad. R. Belg. xxiv: 94 (1850).—Jenman, Ferns Brit. W. Ind.: 391 (1909).—Hieron. in Hedwigia lviii: 303 (1917).

Lycopodium ornithopodioides sensu Sw., Synops. Filic.: 184 (1806) pro parte, quoad pl. ind. occ.; non L.

? *Lycopodium patulum* Sw., op. cit.: 184, 411 (1806).

? *Selaginella patula* (Sw.) Spring in Bull. Acad. Brux. x, 1: 141 (1843) excl. syn.; in Mém. Acad. R. Belg. xxiv: 96 (1850) pro parte.

Selaginella caribensis Jenman in Journ. of Bot. xxiv: 273 (1886); Ferns Brit. W. Ind.: 390 (1909).

Selaginella porelloides sensu Jenman, op. cit.: 391 (1909); non Spring.

Selaginella wilsoni Hieron., tom. cit.: 308 (1917).

Selaginella wilsoni forma *rigidiuscula* Hieron., tom. cit.: 310 (1917).

CUBA. Sierra Nipe, near Woodfred, Oriente, 450–550 m., *Shafer 3166* (BM; NY); Pico Turquino, Oriente, *Leon 11241* (NY); Arroyo Cimarron, Trinidad Mts., Santa Clara, 470 m., *Britton 5111* (NY); Arroyo de Manaca, Herradura, Trinidad Mts., 320 m., *Britton 5030* (NY); Siguanea, Trinidad Mts., Santa Clara, 400 m., *Britton & Wilson 4913* (NY), *4978* (BM; NY); on a rock near the falls of the Caracusey R., Banao Mts., Santa Clara, *Leon & Roca 7907* (NY).

JAMAICA. Without precise locality, *Swartz* (BM), *Jenman* (BM; NY); Morce's Gap, *Clute 60* (NY); Morce's Gap to Vinegar Hill, 1,175–1,500 m., *Maxon & Killip 1304* (BM; NY); Morce's Gap to Cinchona, *Underwood 271* (NY), *1218* (NY); Chester Vale, near Newcastle, Blue Mts., *Carhart* (NY); Blue Mountain, *Orcutt 3169* (K), *5307* (K); Blue Mountain Peak, 1,800–2,100 m., *Maxon & Killip 1134* (NY), *1153* (NY), *Underwood 1502* (NY), *2546* (NY), *2584A* (NY); Portland, *Orcutt 5157* (K); Abbey Green, *Orcutt 5294* (K).

Geographical range: confined to Cuba and Jamaica.

Jenman's specimens of *S. caribensis* at New York and the British Museum do not differ from *S. confusa*.

Hieronymus (*tom. cit.*: 311) refers *Lycopodium patulum* to *S. albo-nitens* Spring, i.e. *S. tenella* (Beauv.) Spring, but the type of *L. patulum* at Stockholm seems to represent *S. confusa* so far as I can judge from a photograph.

7. **Selaginella laxifolia** Bak. ex Krug apud Urb. in Engl., Bot. Jahrb. xxiv: 151 (1897).—Hieron. in Hedwigia lviii: 306 (1917).

Selaginella confusa sensu Krug, loc. cit. (1897) pro parte; non Spring.

PUERTO RICO. Las Mesas, near Mayaguez, 300–350 m., *Leustohn 48* (BM), *Stevens 427* (NY), *Heller 4587* (BM; NY); Quebrado de Limones, near Mayaguez, *Britton & Marble 672* (NY); near Maricao, *Sintenis 399* (type-collection; BM; K; NY), *Stevens 1878* (NY), *Hioram* (BM; NY); La Chiquita, near Maricao, 650–700 m., *Britton & Cowell 4278* (NY); Rio de Maricao, *Hess 531* (NY), *Britton, Stevens & Hess 2458A* (K; NY), *Britton & Cowell 4211* (NY); near Utuado, *Sintenis 6589* (K); near Pepino, *Sintenis 5837* (K; NY); Sarer, *Johnston 2069* (NY).

Geographical range: endemic in Puerto Rico.

This species replaces *S. confusa* in Puerto Rico, and further material may show that it cannot be maintained as distinct.

8. **Selaginella flabellum** (Desv.) Spring in Bull. Acad. Brux. x, 1: 234 (1843).

Lycopodium flabellum Desv. apud Poir. in Encycl. Méth., Bot., Suppl. iii: 558 (1814).—Hook. & Grev. in Hook., Bot. Misc. ii: 385 (1831).
Selaginella porelloides sensu Spring in Mém. Acad. R. Belg. xxiv: 97 (1850) pro parte, excl. syn. Lam.; non Spring sensu orig.—Fée, Mém. Fam. Foug. xi: 133 (1866) pro parte.
Selaginella mayerhoffii Hieron. in Hedwigia lviii: 295 (1917).
Selaginella mayerhoffii var. *nectouxii* Hieron., tom. cit.: 297 (1917).

HISPANIOLA. Without precise locality, *Nectoux* (BM; P, type); Caille à Croix, Dépt. de l'Artibonite, *Leonard 7912* (BM); Cañada Tomesloma, Prov. Barahona, 600 m., *Fuertes 955* (BM).

Geographical range: endemic in Hispaniola.

9. **Selaginella subcaulescens** Bak. in Journ. of Bot. xxii: 277 (1884); Handb. Fern-Allies: 79 (1887).—Hieron. in Hedwigia lviii: 301 (1917).

Selaginella substipitata sensu Griseb., Cat. Pl. Cub.: 271 (1866); non Spring.
Selaginella haenkeana sensu Sauvalle in An. Acad. Habana viii: 413 (1872); non Spring.
Selaginella albo-nitens sensu Urb., Symb. Antill. iv: 69 (1903); non Spring.
Selaginella sintenisii Hieron., tom. cit.: 299 (1917).

CUBA. Without precise locality, *Wright 1822* (BM; K, type; NY); near Monte Verde, *Wright 940 pro parte* (BM); mountains of Oriente, *Hioram* (BM; NY); 'Posesion de Starck', S.E. of Jaguey, Yateras, Oriente, 450–525 m., *Maxon 4440* (BM; NY); Rio Yateras, Jaguey, 600 m., *Eggers 4889* (BM); Gran Piedra, Oriente, 1,500 m., *Shafer 9001* (BM; NY); Gran Piedra range, Oriente, 900 m., *Clément 2074* (BM; NY); Cooper's Ranch, base of El Yunque Mt., Baracoa, *Underwood & Earle 983* (BM; NY); El Yunque Mt., Baracoa, on rocks, *Underwood & Earle 649* (NY); Loma Harenales, south of Sumidero, Pinar del Rio, *Shafer 13794* (NY).

JAMAICA. Without precise locality, *Jenman* (BM; NY); near Troy, in Cockpit Country, 450–660 m., *Underwood 2846* (BM; NY), *3320* (NY); road between Porto Antonio and St. Margaret's Bay, *Underwood 1724* (NY).

PUERTO RICO. Maricao, *Hioram 37* (BM); Los Angeles, near Utuado, *Sintenis 5912* (BM; NY); Utuado, *Underwood & Griggs* (NY); on rock, Collazo R., *Britton 8623* (BM; NY); Guajataca, Sierra de Lares, *Sintenis 6245* (K).

Geographical range: confined to Cuba, Jamaica and Puerto Rico.

10. **Selaginella substipitata** Spring in Bull. Acad. Brux. x, 1: 227 (1843).—Fée, Mém. Fam. Foug. xi: 135 (1866).—Duss, Fl. Crypt. Antill. Franç.: 127 (1904).—Jenman, Ferns Brit. W. Ind.: 395 (1909).—Boldingh, Fl. Dutch W. Ind.: 12 (1909).

Selaginella portoricensis A. Braun in Ann. Sci. Nat., Sér. 5, Bot. iii: 288 (1865).—Bak. in Ann. Bot. v: 170 (1891).—Urb., Symb. Antill. iv: 70 (1903).—Jenman, op. cit.: 394 (1909).
Selaginella stolonifera sensu Husnot, Cat. Crypt. Antill. Franç.: 58 (1870); non Spring.
Selaginella substipitata var. *compacta* Kuhn ex Krug apud Urb. in Engl., Bot. Jahrb. xxiv: 150 (1897), *nom. nud.*
Selaginella nashii Hieron. in Urb., Symb. Antill. vii: 490 (1913).
Selaginella sherringii Hieron. in Hedwigia lviii: 326 (1917).

HISPANIOLA. Morne Maloeuvre, Port Margot, Dépt. du Nord, 1,000–1,150 m., *Ekman 2024* (K); Haut Piton peaks, Bassin Bleu, 630–1,500 m., *Leonard 15158* (BM); road from Camp 1 to La Barrière Couchant, 840 m., *Nash & Taylor 1086* (NY);

Mt. Casse, 1,050 m., *Nash 530* (NY); Lagunas de Cenobi, Moucron, Prov. Monte Cristi, 1,100 m., *Ekman 12714* (K).

PUERTO RICO. Without precise locality, *Sintenis 1549* (ex Urb.); Sierra, *Blauner 320* (BM); Adjuntas, Las Cruces, *Sintenis 4104* (BM; K); Guaraguao Mt., near Adjuntas, *Sintenis 4321* (BM; NY); Larco, *Sintenis 6064* (NY); Hato Arriba, near Arecibo, *Britton 5103* (NY); Yunque, *Stevens & Hess 2806* (NY); Monte Torrecilla, *Britton, Cowell & Brown 5594* (NY); Sierra de Naguabo, *Stevenson 1597* (NY), *Shafer 3236* (NY); Piedra Belleta, Sierra de Naguabo, *Sintenis 1045* (K); Barrio de Maizales, Sierra de Naguabo, *Britton & Cowell 2167* (NY); El Alto de la Bandera, *Stevens 1564* (NY), *1637* (NY), *Britton & Shafer 2088* (NY); between Barranquito and Barros, *Hioram 2* (NY); El Gigante, *Stevens 1510* (NY); Mt. Morales, near Utuado, *Britton & Marble 1080* (NY); Arroyo de los Corchos, *Britton, Cowell & Brown 5277* (NY); Indilra Baja, *Britton 7388* (NY); Luquillo Mts., *Britton 7609* (NY), *Heller 4616* (NY); Monte Alegrillo, *Stevens 2353* (NY); Mt. Mandios, near Jayuya, *Britton & Marble 960* (NY).

SABA. Ex Boldingh.

ST. KITTS. Without precise locality, *Rodger 22* (BM); Belmont, *Britton & Cowell* (NY); upper slopes of Mt. Misery, 750–1,110 m., *Box 292* (BM), *s.n.* (BM); Olivees Mt., on summit, 834 m., *Box 394* (BM); near Dos d'Ans Pond, 930 m., *Howard 11979* (BM).

NEVIS. Mt. Nevis, 600–750 m., *Rodger 35* (BM), *36* (BM).

MONTSERRAT. Chaners Mt., *c.* 600 m., *Shafer 275* (BM; NY).

GUADELOUPE. *Beaupertuis* (ex Spring, type), *Husnot 576* (BM), *l'Herminier 16* (K), *s.n.* (BM).

DOMINICA. Without precise locality, *Morris* (K), *Nicholls* (K), *Hodge 1062* (BM); Mt. Diablotin, *Lloyd 882* (NY); Laudat, *Lloyd 384* (NY), *Eggers 15* (K); Imperial Road, Sylvania, 549 m., *Hodge 3833* (BM); Castle Bruce track, north of Trois Pitons, *c.* 600 m., *Hodge 1225* (BM); Morne Trois Pitons, 763–1,400 m., *Hodge 1415* (BM); Valley of Desolation, *Hodge 1945* (BM).

MARTINIQUE. *Jenman* (NY).

ST. LUCIA. Summit of Morne Gimie, 943 m., *Box 1805* (BM).

ST. VINCENT. Without precise locality, *Smith 1377* (ex Bak.); summit of Soufriere, 900 m., *Howard 11217* (BM).

GRENADA. Without precise locality, *Sherring 160* (BM), *Jenman* (NY); Heights of Grand Etang woods, *Broadway 1662* (BM; NY); Feddon's Camp, 600 m., *Smith 114* (K).

Geographical range: West Indies from Hispaniola eastwards to Trinidad.

S. karsteniana A. Braun and *S. rigida* Bak. from northern South America are closely allied to and perhaps conspecific with this West Indian species.

11. **Selaginella plumosa** (L.) C. Presl, Bot. Bemerk.: 153 (1844) excl. var. *β*.—Alston in Journ. of Bot. lxix: 254 (1931).

Muscus repens, squammosus Plum., Descr. Pl. Amer.: 36, t. 24 fig. b (1693).
Muscus squamosus, ramosissimus, repens Plum., Nov. Pl. Amer., Cat.: 16 (1703).
Muscus squammosus repens Plum., Traité des Fougères: t. 43 (1705).

Lycopodium plumosum L., Sp. Pl. ii: 1105 (1753) excl. syn. Breyn.

Sphagnum 5. Scandens diffusum, foliolis cordato-acuminatis rarioribus amplexantibus Browne, Civ. & Nat. Hist. Jam.: 84 (1756).

Lycopodium stoloniferum Sw., Nov. Gen. & Sp. Pl.: 138 (1788); Fl. Ind. Occ. iii: 1576 (1806) excl. syn. Breyn.

Gymnogynum domingense Beauv. in Mag. Encycl. ix, 5: 480 (1804); Prodr. Aethéog.: 103 (1805).

Lycopodium domingense (Beauv.) Leman in Dict. Sci. Nat. xxvii: 426 (1823).

Lycopodium poeppigianum Hook. & Grev. in Hook., Bot. Misc. ii: 393 (1831).

Selaginella stolonifera (Sw.) Spring in Flora xxi: 193 (1838).—Griseb., Cat. Pl. Cub.: 271 (1866).—Fée, Mém. Fam. Foug. xi: 135 (1866).—Krug apud Urb. in Engl., Bot. Jahrb. xxiv: 150 (1897).

Selaginella stolonifera var. *domingensis* Spring, loc. cit. (1838).

Selaginella stolonifera var. *poeppigiana* (Hook. & Grev.) Spring, loc. cit. (1838).

Selaginella cuspidata sensu Griseb., loc. cit. (1866); non Link.

CUBA. Without precise locality, *Wright 938 pro parte* (NY), *939* (NY); Sumidero, *Poeppig* (BM); Chemin Filantropia, Santiago de Cuba, 600 m., *Clément 705* (BM); Rio Barigua, near Santiago, *Hamilton 266* (NY); near Baracoa, Santiago, *Pollard & Palmer 189* (NY); Cooper's Ranch and base of El Yunque Mt., Baracoa, *Underwood & Earle 878* (NY); hills about Tabajo, base of El Yunque Mt., Oriente, *Shafer 7714* (NY); Rio Yumuri Valley, Sabaua, Baracoa, Oriente, *Leon 17242* (BM); Sierra de Nipe, Oriente, *Ekman 6717* (BM); The Pinales, S.E. of Paso Estancia, Oriente, *Shafer 1728* (NY); lower valley of Rio Mièl, Oriente, *Shafer 4337* (NY); near Piedra Garda, Oriente, *Shafer 3303* (NY); valley of Rio Matamoros, south of Holguin, Oriente, *Shafer 1250* (NY); woods near base of Loma Mensura, Oriente, 680 m., *Shafer 3851* (NY); Ensenada de Mora, *Britton, Cowell & Shafer 12975* (NY); Hoyo de Manicaragua, Santa Clara, *Britton & Wilson 4708* (NY); near Guanabana, Trinidad Mts., Santa Clara, 260 m., *Britton, Earle & Wilson 4753* (NY); Habanilla Falls, Trinidad Mts., Santa Clara, *Britton, Earle & Wilson 4808* (NY); Cieneguita, near Cienfuegos, Santa Clara, *Combs 303* (NY); wooded ravine east of Matanzas, *Britton & Wilson 449* (NY); on serpentine, Canasi, Matanzas, *Roig & Leon 3414* (NY); near Madruga, *Britton & Shafer 715* (NY); near Mananas, *Leon 716* (NY); Rio San Miguel from Volador to Mal Paso, *Wilson 9373* (NY); Santa Catalina, Pinar del Rio, *Hermann 3483* (NY); La Ermita, *Hioram 4942* (NY); Rio Yateras, *Eggers 5070* (NY).

JAMAICA. *Orcutt 10036* (K), *10068* (K).

HISPANIOLA. Without precise locality, *Plumier* (Ox), *Swartz* (BM), *Jacquemont* (NY), *Wright, Parry & Brummel 35* (NY); vicinity of Anse Galette, Gonave I., *Leonard 3037* (NY); dry banks of Boyoton Source, near Port au Prince, *Leonard 10119* (NY); bank of Mole R., near Mole St. Nicolas, *Leonard 13131* (NY); Bombardopolis Road, near Mole St. Nicolas, *Leonard 13251* (NY); vicinity of Ennery, Dépt. de l'Artibonite, *Leonard 9008* (NY), *9019* (NY); foothills, Azua, 300 m., *Rose, Fitch & Russell 3982* (NY); near Santo Domingo City, *Rose, Fitch & Russell 3781* (NY); on bank along brook, La Brande, 210 m., *Nash & Taylor 1624* (NY).

PUERTO RICO. Rio Piedras, *Stevenson 5651* (NY); Naguabo, cultivated, *Sintenis 5441* (BM).

ST. THOMAS. *Nelthrop 9* (NY).

Geographical range: confined to the Greater Antilles from Cuba to Puerto Rico and the Virgin Islands.

This species is the Greater Antillean representative of the widespread tropical *S. marginata* (Humb. & Bonpl. ex Willd.) Spring.

Baker has applied the name *S. plumosa* to a vast mixture of species from Asia, of which the best-known is the common Himalayan species *S. monospora* Spring.

12. **Selaginella fuertesii** Hieron. in Urb., Symb. Antill. vii: 164 (1912).

HISPANIOLA. Near Barahona, 900 m., *Fuertes 537* (type-collection; BM).

Geographical range: endemic in Hispaniola.

This species is apparently allied to the articulate species of South and Central America.

13. **Selaginella leonardi** O. C. Schmidt in Fedde, Repert. Sp. Nov. xx: 155 (1924).

JAMAICA. Near Troy, 600 m., *Perkins 909* (ex Schmidt).

HISPANIOLA. Vicinity of Mission, Fonds Varettes, *c.* 1,000 m., *Leonard 3757* (type-collection; BM; NY; US); vicinity of San Francisco de Macoris, Prov. Pacificador, 400–1,000 m., *Abbott 2137* (BM); east side, Morne la Selle, 1,650 m., *Holdridge 1989* (BM); waterfall on limestone tuff, Ganthier Source-Courtz, Massif de la Selle, 1,250 m., *Ekman 7754* (K); on limestone, Morne la Visite, 2,050 m., *Ekman 1408* (K).

Geographical range: confined to Hispaniola and perhaps Jamaica.

14. **Selaginella plumieri** Hieron. in Urb., Symb. Antill. vii: 488 (1913).

CUBA. Without precise locality, *Wright 940 pro parte* (NY); El Yunque Mt., Baracoa, *Underwood & Earle 942* (BM; NY), *1019* (NY), *1038* (NY), *Pollard & Palmer 140* (NY); Cooper's Ranch, base of El Yunque Mt., Baracoa, *Underwood & Earle 705* (BM; NY), *706* (NY); Bahia Honda to El Rosario, Pinar del Rio, *Shafer 12017* (K; NY); banks of Upper Taco Taco River, Raugel, Pinar del Rio, *Leon 12683* (NY); Rio San Miguel from Volador to Mal Paso, *Wilson 9375* (NY).

HISPANIOLA. Wet woods, Las Filipinas, Prov. Barahona, 600 m., *Fuertes 1108* (BM; NY); Prov. La Vega, 1,300 m., *Fuertes 1773* (BM; NY); Loma la Vieja, Constanza, Prov. La Vega, 2,000 m., *Ekman 14055* (K); near Furcy, 1,300 m., *Leonard 4501* (NY); Los Asparejos, Moncion, Prov. Monte Cristi, 1,800 m., *Ekman 12781* (K); Morne Melanga, Massif de la Caselle, Port au Prince, 1,200 m., *Ekman 5897* (K).

Geographical range: confined to Cuba and Hispaniola.

15. **Selaginella krugii** Hieron. in Urb., Symb. Antill. iii: 526 (1903).—Urb., op. cit. iv: 70 (1903).—Maxon in Sci. Surv. Porto Rico & Virgin Is. vi: 519 (1926).

Selaginella portoricensis sensu Krug apud Urb. in Engl., Bot. Jahrb. xxiv: 151 (1897) pro parte; non A. Braun.

PUERTO RICO. Sierra, *Blauner 320* (NY), *320A* (BM); Sierra de Luquillo, *Sintenis 1548* (BM; NY), *Heller 1091* (NY), *4616* (NY), *Wilson 92* (NY), *134* (NY), *Hioram 384* (NY); Catalina–Yunque trail, Luquillo Mts., 600 m., *Britton & Bruner 7575* (NY); El Yunque, Rio Piedras, *Walcott 2809* (NY); Monte el Duque, Sierra de Naguabo, *Shafer 2233* (NY); S.W. side of Loma Francesca to falls of Rio Prieto, Sierra de Naguabo, 300–600 m., *Shafer 3208* (NY); Rio Prieto, Sierra de Naguabo, 690–1,035 m., *Shafer 3625* (NY).

Geographical range: endemic in Puerto Rico.

16. **Selaginella denudata** (Willd.) Spring in Flora xxi: 212 (1838); in Bull. Acad. Brux. x, 1: 138 (1843); in Mém. Acad. R. Belg. xxiv: 84 (1850).

Lycopodium denudatum Willd. in L., Sp. Pl., ed. 4, v: 36 (1810).

Lycopodium didymostachyum Desv. apud Poir. in Encycl. Méth., Bot., Suppl. iii: 553 (1814).

Selaginella didymostachya (Desv.) Spring in Bull. Acad. Brux. x, 1: 144 (1843); in Mém. Acad. R. Belg. xxiv: 130 (1850).—Fée, Mém. Fam. Foug. xi: 134 (1866) excl. var.

Selaginella didymostachya var. *subintegerrima* Spring, tom. cit.: 131 (1850).

Selaginella flexuosa sensu Griseb., Fl. Brit. W. Ind. Is.: 645 (1864); non Spring.

Selaginella didymostachya var. *integerrima* sensu Jenman, Ferns Brit. W. Ind.: 395 (1909); non Spring.

Selaginella didymostachya var. *densa* Jenman, loc. cit. (1909).

JAMAICA. Without precise locality, *Herb. Desvaux* (P), *Jenman 78* (NY), *Macfadyen* (K); Cinchona to Morce's Gap, 1,500 m., *Underwood 1219* (NY); Morce's Gap to Vinegar Hill, 1,175–1,500 m., *Maxon & Killip 707* (BM; NY), *1309* (BM; NY), *Underwood 2598A* (NY); Hardware Gap, Blue Mts., *c.* 1,200 m., *Rendle 143* (BM); Silver Hill Gap to Hardware Gap, *Maxon & Killip 1262* (NY); Mabess R., *Harris 7491* (NY), *s.n.* (BM); Mt. Moses, *Bot. Dept. Jamaica* (BM); Moody's Gap, 900 m., *Underwood 1581* (NY), *2141* (NY), *E. Britton 3376* (NY); Cuna-Cuna Gap, 750 m., *Clute 290* (NY), *Underwood 2724* (NY); between House Hill and Cuna-Cuna Gap, St. Thomas, 550–725 m., *Maxon 8928* (NY); road to Vinegar Hill, *Underwood 1365* (NY); near Vinegar Hill, 360 m., *Maxon 2777* (NY); Tweedside, 600–900 m., *Underwood 2044* (NY), *2056* (NY), *2099* (NY); Chester Vale, near Newcastle, Blue Mts., *Carhart* (NY); near St. Helen's Gap, St. Andrew, 1,475 m., *Maxon & Killip 981* (NY); east of Seamen's Valley, Portland, 200–425 m., *Maxon & Killip 250* (NY).

Geographical range: endemic in Jamaica.

This species was recorded from Hispaniola by Fée (*de Tussac*, as *S. didymostachya* var. *integerrima* Spring ex Fée) and from Guadeloupe by Urban (Symb. Antill. ix: 392 (1925)). Both records are presumably erroneous.

The affinity of *S. denudata* appears to be with *S. faucium* Liebm. (Mexico), *S. tarapotensis* Bak. (Peru) and *S. flexuosa* Spring (southern Brazil).

17. **Selaginella hispida** (Willd.) A. Braun ex Urb., Symb. Antill. ix: 394 (1925).

Lycopodium hispidum Willd. in L., Sp. Pl., ed. 4, v: 35 (1810).—Spreng. in L., Syst. Veg., ed. 16, iv, 1: 17 (1827).

Selaginella swartzii Spring in Bull. Acad. Brux. x, 1: 140 (1843).—Alston in Journ. of Bot. lxix: 257 (1931); in Proc. Nat. Inst. Sci. Ind. xi: 231 (1945).

Selaginella lasiophylla A. Braun ex Maxon in Journ. Wash. Acad. Sci. xiv: 199 (1924) pro parte, quoad pl. jamaic.

JAMAICA. Without precise locality, *Swartz* (type-collecton; BM; G); near Ispwich, St. Elizabeth, 200–300 m., *Maxon & Killip 1508* (BM; NY); Cooks Bottom, north of Ipswich, St. Elizabeth, 400–450 m., *Maxon & Killip 1465* (BM; NY); near Troy, 600 m., *Perkins 1370* (K); vertical limestone cliff, Manchester, *Britton 3743* (NY); Parish of Manchester, *Britton* (BM); Schwallenberg, *Orcutt 3945* (BM).

Geographical range: endemic in Jamaica.

Sprengel's record of *Lycopodium hispidum* from Hispaniola may refer to *S. plagiochila*.

18. **Selaginella plagiochila** Bak. in Journ. of Bot. xxi: 212 (1883).

Selaginella lasiophylla A. Braun [in Sitzungsber. Ges. Naturf. Fr. Berl. 1863: 8 (1863), *nom. nud.*] ex Maxon in Journ. Wash. Acad. Sci. xiv: 199 (1924) excl. pl. jamaic.

Selaginella confusa sensu Griseb., Cat. Pl. Cub.: 271 (1866); non Spring.—Sauvalle in An. Acad. Habana viii: 413 (1872).

Selaginella flexuosa sensu Griseb., loc. cit. (1866); non Spring.

? *Selaginella pilosiuscula* Kuhn ex Krug apud Urb. in Engl., Bot. Jahrb. xxiv: 151 (1897), *nom. nud.*

CUBA. Without precise locality, *Wright 1825 pro parte* (NY); near Monte Verde, *Wright 942* (BM; K, type; NY); El Yunque Mt., Baracoa, *Underwood & Earle 676* (NY), *696* (NY), *906* (BM; NY); Sierra de Cabra, Pinar del Rio, *Britton & Cowell 7291* (NY), *9791* (NY).

ISLE OF PINES. Moist bank of arroyo a few miles east of Los Indios, *Jennings 367* (NY); near Los Indios, *Britton & Wilson 14257* (BM; NY); Sierra de Cañada, *Britton & Wilson 14418* (BM; NY).

HISPANIOLA. Los Naranjos, trail Laguna to Rincon, Prov. Samaná, *c.* 250 m., *Ekman 15020* (K).

Geographical range: confined to Cuba, the Isle of Pines and Hispaniola.

The pubescent upper surface of the lateral leaves, combined with the minute ovate median leaves, is distinctive.

I have not seen *Torralbas 352*, the specimen cited for Kuhn's *S. pilosiuscula*, but probably it is referable to *S. plagiochila* as this is the only Cuban species with a pubescent surface. José I. Torralbas (1842–1903) was a Cuban botanist who sent a small collection to Urban. He is mentioned in Leon's account of the botanical exploration of Cuba (Mem. Soc. Poey iii: 198 (1918)).

19. **Selaginella cordifolia** (Desv.) Spring in Bull. Acad. Brux. x, 1: 228 (1843).

Lycopodium cordifolium Desv. apud Poir. in Encycl. Méth., Bot., Suppl. iii: 548 (1814).

Selaginella patula var. *cordifolia* (Desv.) Griseb., Cat. Pl. Cub.: 271 (1866).

Selaginella ottonis Bak. in Journ. of Bot. xxiii: 179 (1885).

Selaginella serpens sensu Krug apud Urb. in Engl., Bot. Jahrb. xxiv: 150 (1897) pro parte; non Spring.

Selaginella serpens var. *acutiuscula* Hieron. in Urb., Symb. Antill. ix: 392 (1925), *nom. nud.*

CUBA. Without precise locality, *Otto 231* (K); vicinity of Baracoa, *Pollard & Palmer 253* (BM; NY); Rio Toa, Baracoa, Oriente, *Ekman 4348* (BM; NY); Cooper's Ranch, base of El Yunque Mt., Baracoa, *Underwood & Earle 876* (BM; NY); hills about Tabajo, base of El Yunque Mt., *Shafer 7967* (NY); Arroyo Bayaja, south of Nagua, Sierra Maestra, 200–400 m., *Ekman 14771* (BM; NY).

HISPANIOLA. Barahona, 700 m., *Fuertes 975* (BM; NY).

PUERTO RICO. Without precise locality, *Herb. Desvaux* (P, type); Sierra de Naguabo, *Sintenis 5431* (BM; NY); vicinity of Barranquitos, *E. G. Britton 5585* (BM;

NY), *Britton & Brown 6625* (BM; NY); Dos Bocas, above Corozal, *Britton & Chardon 8937* (BM; NY); 22 km. south of San Juan, *Heller 674* (BM; NY); bank near Cayey, *Britton 8545* (NY); bank near Aquas Buenas, *Britton 9191* (NY); rocky bank near Comario, *Barker 10* (NY).

Geographical range: Greater Antilles except Jamaica, and northern Brazil (?).

The type of *S. ottonis* (*Otto 231*) at Kew is very scrappy but shows clearly the cordate ciliate leaf-base of *S. cordifolia*. Baker had himself written 'cf. *S. cordifolia*' on the sheet.

20. **Selaginella heterodonta** (Desv.) Hieron. in Urb., Symb. Antill. ix: 392 (1925).

Lycopodium heterodonton Desv. apud Poir. in Encycl. Méth., Bot., Suppl. iii: 548 (1814).

Selaginella sarmentosa A. Braun in Index Sem. Hort. Bot. Berol. 1857, App.: 14 (1858?); in Ann. Sci. Nat., Sér. 4, Bot. xiii: 62 (1860).

Selaginella patula sensu Griseb., Fl. Brit. W. Ind. Is.: 645 (1864); non Spring.—Jenman, Ferns Brit. W. Ind.: 400 (1909).

Selaginella brevicaulis Bak. in Journ. of Bot. xxi: 83 (1883).

Selaginella conferta Bak., op. cit. xxii: 113 (1884); non *S. conferta* Moore (1861).

Selaginella setigera Jenman in Journ. of Bot. xxiv: 273 (1886); Ferns Brit. W. Ind.: 400 (1909).

Selaginella microphylla sensu Krug apud Urb. in Engl., Bot. Jahrb. xxiv: 150 (1897); non Spring.

CUBA. Without precise locality, *Guthnick 4* (BM), *Wright 940* (NY), *3909* (BM; NY); Monte Verde, *Wright 5* (BM); near Monte Verde, *Wright 941* (K); vicinity of Camp San Benito, Oriente, 900 m., *Shafer 4096* (NY); valley of Rio Yamaniguay, Oriente, *Shafer 4210* (NY); Rio Macaguanigua, Oriente, *Shafer 3967* (NY); Cooper's Ranch, base of El Yunque Mt., Baracoa, *Underwood & Earle 877* (NY); Arroyo Trinitario, Rio Negro, Trinidad Mts., Santa Clara, 550 m., *Britton 5206* (NY); Aguacate, Trinidad Mts., 750–850 m., *Britton 5382* (NY), *5385* (NY); El Porvenir, Trinidad Mts., 650–750 m., *Britton & Wilson 5286* (NY); Viñales, Pinar del Rio, *Killip 13577* (BM), *Cuesta 636* (NY); north of San Diego de los Baños, Pinar del Rio, *Leon 4493* (BM; NY); Cueva del Rio San Vicente, Viñales, Pinar del Rio, *Leon & Killip 14707* (BM; NY); Baños San Vicente, Pinar del Rio, *Britton & Gager 7341* (BM; NY); Luiz Lazo, Pinar del Rio, *Roig 3130* (NY); Sierra Guayaba, south of Sumidero, Pinar del Rio, *Shafer 13853* (BM; NY); vicinity of Sumidero, *Shafer & Leon 13646* (BM; NY), *13668* (NY).

JAMAICA. Without precise locality, *Herb. Desvaux* (P, type), *Wilson 136* (K), *Morris 503* (K); on sloping rock in stream-bed, Seamen's Valley, Portland, 150–250 m., *Maxon & Killip 46* (BM; NY); Mabess R., *Harris 7492* (BM); on rock in damp woods near Port Antonio, *Fredholm 3124* (NY).

HISPANIOLA. Barahona, *Fuertes 924* (BM).

Geographical range: confined to the Greater Antilles.

21. **Selaginella serpens** (Desv.) Spring in Bull. Acad. Brux. x, 1: 228 (1843).—Duss, Fl. Crypt. Antill. Franç.: 126 (1904).—Jenman, Ferns Brit. W. Ind.: 395 (1909).

Selago 1. Ramosa repens, et radiculosa, spicillis quadratis Browne, Civ. & Nat. Hist. Jam.: 83 (1756).

Lycopodium serpens Desv. apud Poir. in Encyl. Méth., Bot., Suppl. iii: 553 (1814).

Lycopodium plumosum sensu Lunan, Hort. Jam. ii: 304 (1844); non L.

CUBA. Without precise locality, *Wright 941* (NY), *1821* (BM); near Baracoa, *Pollard & Palmer 51* (NY); Cooper's Ranch, base of El Yunque Mt., Baracoa, *Underwood & Earle 523* (BM; NY), *821* (NY), *825* (NY), *943* (BM; NY); lower valley of Rio Navas, Oriente, *Shafer 4373* (NY); Sierra Nipe, near Woodfred, Oriente, in rocky (serpentine) arroyo, 360–550 m., *Shafer 3577* (NY); San Diego de los Baños, Pinar del Rio, *E. G. Britton 6837* (NY), *Britton, Earle & Gager 6899* (NY); upper valley of Taco Taco River, Raugel, Pinar del Rio, *Leon 12694* (NY); on cliffs, gorges of Santa Cruz R., Santa Cruz de los Pinos, Pinar del Rio, *Roca 7408* (NY); Guane Road, Sierra de Cabra, Pinar del Rio, *Britton & Shafer 7227* (NY); Rio Mananteales, north of Candelaria, Pinar del Rio, *Britton, Wilson & Leon 14116* (NY); Rio Mestanza, Pinar del Rio, *Britton & Cowell 10163* (NY); near Pinar del Rio, *Britton & Cowell 9716* (NY); mountain, Ubero R., Sevilla Estate, near Santiago, *Taylor 266* (NY); Jayabo Mt., Guama R., near Santiago, 645 m., *Taylor 378* (NY); Obispo Hill, S. Spiritus, Santa Clara, *Leon 1283* (NY); near S. Spiritus, Santa Clara, *Sergius 2704* (BM; NY); Banao Hills, near Jayabo R., Santa Clara, *Leon & Cesareo 4080* (NY); banks of Jayabo R., Banao Hills, *Leon & Cesareo 4034* (NY); Loma de Canta, Banao Mts., *Leon & Clément 5580* (NY).

JAMAICA. Without precise locality, *Herb. Desvaux* (P, type), *Swartz* (BM), *Jenman* (NY), *Wilson* (NY); Bath Fountain, *Miss Noel* (BM); Bath, *Underwood 2824* (NY), *Clute 48* (NY); Mansfield, near Bath, *Underwood 2820* (NY); Bath to Cuna-Cuna Pass, 300–600 m., *Underwood 2672* (NY); Bog Walk, *Hitchcock 16* (NY), *Crawford 813* (NY); Bowers Wood Road, Bog Walk, *Britton 2613* (NY); Guava Ridge and Gordon Town, *Jenman* (NY); above Gordon Town, 450 m., *Clute 235* (NY); near Castleton, *Underwood 31* (NY), *32* (NY), *36* (NY), *75* (NY), *76* (NY), *80* (NY), *118* (NY), *1732* (NY), *1992* (NY); Dolphin Head, *E. G. Britton 635* (NY); cliffs, Bagwell Gorge, *Ridley* (K); Chester Vale, near Newcastle, *Carhart* (NY); Green Island and vicinity on dry rocky hill, *Britton & Hollick 2130* (NY).

HISPANIOLA. Premier Source, Les Roseaux, Massif de la Hotte, *Ekman 10202* (K).

GUADELOUPE. Soufrière, *de Ponthieu* (BM); sur les rochers les plus élevés du plateau de la Soufrière, *Duss 3753* (ex Duss); rochers au bord du Galion, *Duss 3969* (ex Duss).

MARTINIQUE. Rochers du morne Paillasse, du morne de La Croix, près du lac des Palmistes, *Duss 4134* (ex Duss).

Geographical range: Cuba, Jamaica, Hispaniola and Guadeloupe; reported from Martinique.

This species is well known for its daily change of colour. In the morning the leaves are bright green, but towards evening they become pale and silvery. The change of colour is due to contraction of the cell-contents of the epidermal cells away from the cuticle, which leaves a layer of air between the cuticle and the chloroplasts in the latter part of the day. The phenomenon has been described by Sussenguth (in Biol. Zentralbl. xliii: 123–129 (1923)).

22. **Selaginella prasina** Bak. in Journ. of Bot. xxii: 113 (1884).

Selaginella crassinervia sensu Griseb., Cat. Pl. Cub.: 271 (1866); non Spring.

Selaginella sp. (cum descr.) Sauvalle in An. Acad. Habana viii: 414 (1872).

CUBA. Without precise locality, *Wright 1825* (BM; K, syntype; NY); rocks on bank of R. Agabama, between Espiritu Santo and Villa Clara, *Wright 1825B* (K, syntype); rocky stream-bed, Rio San Juan, Santa Clara, *Britton, Earle & Wilson 5862* (BM; NY); Rio Mananteales, north of Candelaria, Pinar del Rio, *Britton, Wilson & Leon 14122* (BM; NY); banks of Rio Mananteales, near Soroa, *Britton, Wilson & Leon 6037* (NY); hanging from a cascade, Jayabo R., Banao Hills, *Leon 4061* (NY); on soft limestone, valley of Rio de Marianas, Havana, *Leon 4814* (NY); below the falls at Loma Boba near San José, *Smith, Hodgdon & Gonzalez 3273* (Gray).

Geographical range: endemic in Cuba.

This is separated from the other small species found in Cuba by its ovate or subacute (not aristate) median leaves.

23. **Selaginella tenella** (Beauv.) Spring in Bull. Acad. Brux. x, 1: 234 (1843).

Diplostachium tenellum Beauv. in Mag. Encycl. ix, 5: 481 (1804); Prodr. Aethéog.: 104 (1805).

Lycopodium tenellum (Beauv.) Desv. apud Poir. in Encycl. Méth., Bot., Suppl. iii: 553 (1814).

Selaginella albo-nitens Spring, tom. cit.: 139 (1843).—Jenman, Ferns Brit. W. Ind.: 393 (1909).—Hieron. in Hedwigia lviii: 310 (1917).

Selaginella mollis Fée, Mém. Fam. Foug. xi: 133, t. 34 fig. 1 (1866); non *S. mollis* A. Braun (1865).

Selaginella apus sensu Bak. in Ann. Bot. v: 170 (1891); non Spring.

Selaginella albo-nitens forma *typica* Hieron., tom. cit.: 311 (1917).

CUBA. Without precise locality, *Wright 940 pro parte* (K; NY); near Loma del Gato, Cobre Range, *Leon, Clément & Roca 484* (NY), *10031* (NY), *10392* (NY); Cooper's Ranch, base of El Yunque Mt., Baracoa, *Underwood & Earle 302* (BM; NY), *514* (BM; NY), *1076* (NY), *1362* (NY); Rio Macaguanigua, Oriente, *Shafer 3972* (NY), *3979* (NY).

JAMAICA. Without precise locality, *Swartz* (BM); River Head near Swarton, *Underwood 1918* (NY), *1919* (NY); Mabess R., *Harris 7493* (NY); Ipswich, *Orcutt 7772* (K); Spring Garden, Portland, *Orcutt 4762* (BM), *4763* (BM).

HISPANIOLA. Port Mayot to Correil, *Nash 197* (NY); Thor Source, vicinity of Port au Prince, *Leonard 10111* (BM); Puilboreau Pass, vicinity of Ennery, Dépt. de l'Artibonite, 325–900 m., *Leonard 9135* (BM), *9539* (BM); Trois Rivières, near Plaisance, vicinity of Ennery, Dépt. de l'Artibonite, 325–900 m., *Leonard 9201* (BM); vicinity of Marmelade, Dépt. du Nord, *c.* 800 m., *Leonard 8160* (BM); bank of Jean Rabel river, vicinity of Jean Rabel, *Leonard 12810* (BM; NY); vicinity of Plaisance, Dépt. du Nord, *c.* 400 m., *Leonard 9285a* (BM), *9398* (BM); vicinity of St. Louis du Nord, *Leonard 14152* (BM), *14222* (BM; NY), *14272* (BM; NY); Morne Chavary, vicinity of St. Louis du Nord, *Leonard 14545* (BM); La Coup Road, vicinity of Port de Paix, *Leonard 12278* (BM), *12300* (BM); Barrabas, *Raunkiaer* (BM); Sanchez, *Rose, Fitch & Russell 1192* (BM; NY); Las Cañitas, sea-level, *Abbott 2720* (BM); Azui, Prov. Ceibo, *Taylor 278A* (NY).

PUERTO RICO. Without precise locality, *Herb. Desvaux* (P); La Juanita, near Las Marias, *E. Britton 3956* (NY); Sierra de Naguabo, Barrio de Maizales, *Britton & Cowell 2119* (NY); Pueblo Viego, *Hioram 1* (NY); ravine between Morovis and Corozal, *Britton & Boynton 8435* (BM; NY); ravine above Corozal, *Britton 7788* (NY), *Britton & Boynton 8351* (NY); bank near Aguas Buenas, *Britton 9192* (BM; NY); near Rio Pedras, *Dale* (NY), *Johnston & Stevenson 1363* (BM; NY); near Utuado, *Britton & Cowell 994* (NY); between Arecibo and Utuado, *E. Britton 2071* (NY); near Dona Juana Waterfall, Toro Negro, *Britton & Brown 6216* (NY); vicinity of Ala de la Piedra above Villalba, 700–750 m., *Britton & Brown 6130* (BM; NY); between Guayama and Cayey, *Britton & Brown 7017* (NY); near Cayey, *Underwood & Griggs 279* (NY); ravine at Experiment Station near Mayaguez, *Britton & Marble 545* (NY); Luquillo Mts., *Heller 758* (BM; NY); 22 km. south of San Juan, *Heller 670* (BM; NY).

SABA. Ganiby Gut, *Suringar* (BM; Ley).

ST. KITTS. Nine Turn Gut, 360 m., *Box 351* (BM); Molyneux Estate, in forest, *Britton & Cowell 322* (BM; NY).

MONTSERRAT. Pond Mts., near Roches, *Shafer 721* (BM; NY); Fergus Mt., 600 m., *Shafer 334* (BM; NY).

GUADELOUPE. Without precise locality, *l'Herminier* (BM); Rivière des Habitants, St. Louis, *l'Herminier* (ex Fée).

DOMINICA. Waterfalls of Massacre R., between Sylvania and Mt. Joy, 500 m., *Hodge 1369* (BM).

ST. VINCENT. *Smith 1376* (K), *1377* (K).

Geographical range: West Indies.

This species is very closely allied to *S. cladorrhizans* A. Braun, which is found in Trinidad and Venezuela.

24. **Selaginella armata** Bak. in Journ. of Bot. xxii: 90 (1884); Handb. Fern-Allies: 69 (1887).

Selaginella patula sensu Sauvalle in An. Acad. Habana viii: 413 (1872); non Spring.

Selaginella rotundifolia sensu Sauvalle, loc. cit. (1872); non Spring.

Selaginella rhodospora Bak. in Journ. of Bot. xxii: 111 (1884).—Jennings in Ann. Carnegie Mus. xi: 48 (1917).

Selaginella consimilis Bak., op. cit. xxiii: 179 (1885).

Selaginella plagiochila sensu Krug apud Urb. in Engl., Bot. Jahrb. xxiv: 150 (1897) pro parte, quoad pl. portoric.; non Spring.—Urb., Symb. Antill. iv: 70 (1903).—Maxon in Sci. Surv. Porto Rico & Virgin Is. vi: 518 (1926).

Selaginella eatoni Hieron. ex Small, Ferns Trop. Florida: 67, fig. 49 (1918).

Diplostachium eatoni (Hieron. ex Small) Small, Ferns Southeast. St.: 422 (1938).

CUBA. Without precise locality, *Wright 1824* (BM; K), *3907* (BM; K), *3908* (BM; K, type; NY); Guala Hill, Mendoza, not far from Tapaste, Havana, *Leon 3602* (NY); Sierra Mendoza, Pinar del Rio, *Shafer 11150* (BM; NY); on limestone, Monte Villa Real, near Cojimar, Havana, *Leon & Hioram 4721* (NY); near Herradura, *Britton 6531* (NY); limestone rocks, San Diego de los Baños, Pinar del Rio, *Britton, Earle & Gager 6716* (BM; NY).

ISLE OF PINES. Nueva Gerona, *Curtiss* (NY); vicinity of Los Indios, *Britton & Wilson 14260* (BM; NY).

JAMAICA. Farm Hill Works, *Orcutt 5473* (BM); vertical face of wet shaded cliff, Mt. James, St. Andrew, *c.* 450 m., *Maxon 8517* (Gray).

HISPANIOLA. Puilboreau Pass, vicinity of Ennery, Dépt. de l'Artibonite, 325–900 m., *Leonard 9081* (BM), *9082* (BM); Santo Domingo, without precise locality, *Wright, Parry & Brummel* (Gray).

PUERTO RICO. Sierra de Naguabo, Rio Blanco, *Sintenis 5385* (BM); moist base of large boulders along river Cubuy to Meseta Falls, Sierra de Naguabo, 60–210 m., *Shafer 3151* (BM; NY); road from Cayey to Guyana, *Underwood & Griggs 315* (BM; NY).

Geographical range: southern Florida and the Greater Antilles.

This is separated from the other small species by its elliptic-lanceolate ciliate median leaves with conspicuous white margins.

25. **Selaginella bracei** Hieron. ex O. C. Schmidt in Fedde, Repert. Sp. Nov. xx: 156 (1924).

Selaginella eatoni sensu Britton & Millsp., Bahama Fl.: 477 (1920); non Hieron.
Selaginella sagraeana Hieron. ex O. C. Schmidt, tom. cit.: 157 (1924), *nom. nud.*

ANDROS (BAHAMAS). Mastic Point and vicinity, *Brace 7001* (NY), *7024* (syntype-collection; BM); Savannah, near Standard Creek, Northern Section, in lime sinks, *Small & Carter 8879* (BM; NY); Coppice, near Fresh Creek, Northern Section, in lime sinks, *Small & Carter 8780* (NY).

CUBA. Without precise locality, *Wright 3908 pro parte* (NY); base of limestone cliff, vicinity of Viñales, Pinar del Rio, *Britton 7527* (BM; NY); railroad culvert near Ibarra, Matanzas, *Britton & Shafer 801* (BM; NY); coral rock cliffs on shore, Playa, Matanzas, *Britton & Shafer 56* (NY); valley of the Caniruas, vicinity of Matanzas, *Britton & Shafer 799* (BM; NY); Cueva de Cotilla, Havana, *Wilson & Leon 3374* (NY); on rocks at mouth of cave, Cumbre Hermosa, Havana, *Wilson & Leon 11627* (NY); coral rock, valley of the San Juan, near Madruga, *Britton & Shafer 287* (NY).

Geographical range: confined to the Bahamas and Cuba.

26. **Selaginella rotundifolia** Spring in Bull. Acad. Brux. x, 1: 139 (1843); in Mém. Acad. R. Belg. xxiv: 85 (1850).—Fée, Mém. Fam. Foug. xi: 133, t. 34 fig. 2 (1866).—Bak., Handb. Fern-Allies: 68 (1887).—Duss, Fl. Crypt. Antill. Franç.: 125 (1903).

? *Jungermannia mastigophora* Spreng. in L., Syst. Veg., ed. 16, iv, 1: 222 (1827).
Selaginella confusa sensu Griseb., Fl. Brit. W. Ind. Is.: 645 (1864) pro parte, quoad pl. S. Vincent.; non Spring.

ST. KITTS. Upper slopes of Mt. Misery, 750–1,110 m., *Box* (BM).

GUADELOUPE. Without precise locality, *Beaupertuis* (BM; P, syntype), *l'Herminier* (BM); Gombeyre (habit. Le Bisdary), Camp-Jacob, Trois-Rivières, Lamentin (Ravine-Chaude), &c., *Duss 3995* (ex Duss).

DOMINICA. Without precise locality, *Jenman* (NY), *Lloyd a* and *b* (NY); Laudat, *Lloyd 81* (NY); Boiling Lake, *Noel* (NY); Goodwill Valley, *Eggers* (K); Hatton Garden, *Hodge 3036* (BM).

MARTINIQUE. Without precise locality, *Steinheil* (P, syntype); Morne Rouge, *Hahn* (BM); near Thermes (ex Fée); Petit île de Saint-Pierre (ex Fée); Saint-Pierre (Collège, Trois-Ponts), Pointe-Fine, camp de l'Alma, fontaines Didier et Absalon, *Duss 1597, 4595* and *4595a* (ex Duss).

St. Lucia. Upper slopes of Morne Gimie, 600–930 m., *Box* (BM); Canaries Gorge, 90 m., *Box 431* (BM); Malmaison, near Soufriere, 450 m., *Box 1873* (BM).

St. Vincent. Foot of Morne Garou, 900 m., *Smith 1375* (K); St. Andred, *Guilding* (K).

Grenada. Without precise locality, *Jenman* (NY), *Sherring* (BM); close to a waterfall, Annandale, *Broadway 1893* (NY), *5960* (BM), *7036* (BM).

Geographical range: confined to the Lesser Antilles.

There is a letter from Sereno Watson at Kew which shows that *S. rotundifolia* is Sprengel's *Jungermannia mastigophora* as interpreted by some authors. Sprengel gives the locality of his species as 'Guiana. *Perrin*'.

27. **Selaginella ovifolia** Bak. in Journ. of Bot. xxii: 90 (1884); Handb. Fern-Allies: 68 (1887).—Urb., Symb. Antill. iv: 70 (1903).

? *Selaginella rotundifolia* sensu Urb., op. cit. ix: 392 (1925); non Spring.

Jamaica. Farm Hill, *Orcutt 3465* (BM; K).

Hispaniola. La Coup Road, vicinity of Port de Paix, *Leonard 12276* (BM; NY), *12292* (BM; NY); vicinity of Jean Rabel, *Leonard 13728* (BM; NY); near Marmelade, Massif du Nord, *c.* 700 m., *Ekman 8314* (K); on rock in stream, ravine N.W. of Marmelade, 600 m., *Nash & Taylor 1342* (NY); on ground in pine land, Camp 4, Marmelade, 750 m., *Nash & Taylor 1300* (NY); vicinity of Ennery, Dépt. de l'Artibonite, 325–900 m., *Leonard 9036* (BM), *9053* (BM); vicinity of Dondon, Dépt. du Nord, *c.* 400 m., *Leonard 8612* (BM).

Puerto Rico. Without precise locality, *Schwanecke* (K, type); summit of El Yunque, Sierra de Luquillo, *Sintenis 1550* (K; NY); Monte los Rabanos, Sierra de las Piedras, *Sintenis 5478* (K); crevices of rock, valley of the Toro Negro, north of Villalba, 550–600 m., *Britton & Horne 7485* (NY), *7486* (BM; NY); wet shaded cliff, valleys near Dona Juana Waterfall, Toro Negro, *c.* 700 m., *Britton & Brown 6215* (BM; NY); bank, Guayama–Cayey Road, 700–750 m., *Britton & Earle 6459* (NY); Monte Torrecilla, 900–1,100 m., *Britton, Cowell & Brown 5649* (NY); summit of Loma la Mina, Sierra de Naguabo, *c.* 945 m., *Shafer 3323* (BM; NY), *3330A* (NY).

Geographical range: confined to Jamaica, Hispaniola, Puerto Rico and British Honduras.

This species closely resembles *S. rotundifolia*, from which it is separated by its ciliate (not denticulate) leaves. The subacute lateral leaves separate it from *S. plagiochila*, and the ovate median leaves from *S. armata*.

Introduced Species

Selaginella kraussiana (Kunze) A. Braun.

Jamaica. Cinchona, escaped from cultivation, *Harris 7894* (BM; NY), *Orcutt 5486* (K; NY), *5498* (K), *Clute 347* (NY), *Maxon & Killip 562* (BM; NY).

Native of South and Tropical Africa; the commonest species in cultivation, now found as an escape in many countries.

SELAGINELLA PLANA (Desv.) Hieron.

Selaginella willdenovii sensu Maxon in Sci. Surv. Porto Rico & Virgin Is. vi: 521 (1926); non Bak.

JAMAICA. Woods, eastern slopes, south end of John Crow Mts., St. Thomas, *Britton 4195* (NY).

PUERTO RICO. Mayaguez, *Hess 2213* (NY).

ST. THOMAS. Cultivated, *Miss Morrow 89* (NY).

Native of the Malay Archipelago; commonly cultivated and now well established in some tropical countries.

SELAGINELLA VITICULOSA Klotzsch.—Britton, Fl. Bermuda: 429 (1918).

BERMUDA. Escaped from a greenhouse, shaded wall, Mt. Langton, *Brown, Britton & Seaver 1189* (NY).

Native of Venezuela; in cultivation for many years and found as an escape in Brazil

EXCLUDED SPECIES

SELAGINELLA ANOMALA (Hook. & Grev.) Spring.—Fée, Mém. Fam. Foug. xi: 135 (1866).

GUADELOUPE. *L'Herminier* (ex Fée).

Conspecific with *S. porelloides*, a species found in Trinidad and Guiana. The Guadeloupe record probably refers to *S. tenella.*

SELAGINELLA APUS Spring.—Duss, Fl. Crypt. Antill. Franç.: 125 (1904).

MARTINIQUE. Sur les rochers entre le Fond-Canonville et la Fontaine-Chaude, au pied des murs et des parois des cases à bains, sur les murs des canaux d'irrigation du jardin bot. de St-Pierre, *Duss 4132* (ex Duss).

A North American species. The Martinique records probably refer to *S. tenella.*

SELAGINELLA FLEXUOSA Spring.—Krug apud Urb. in Engl., Bot. Jahrb. xxiv: 150 (1897).

MARTINIQUE. *Duss 1600* (ex Krug).

A Brazilian species very different from any known from Martinique.

SELAGINELLA JUNGERMANNIOIDES (Gaud.) Spring.—Fée, Mém. Fam. Foug. xi: 134 (1866).

HISPANIOLA. *De Tussac* (ex Fée).

MARTINIQUE. La Calebasse, *Mlle. Rivoire* (ex Fée).

This is a Brazilian species which resembles *S. serpens.* The West Indian records probably refer to that species.

SELAGINELLA MARTENSII Spring.—Krug apud Urb. in Engl., Bot. Jahrb. xxiv: 151 (1897).—Duss, Fl. Crypt. Antill. Franç.: 127 (1904).

GUADELOUPE. Savanes du Camp-Jacob, Savane-à-Mulets (près de la source du Galion), &c., *Duss 3752* (ex Krug and Duss).

MARTINIQUE. Savanes supérieures de l'Ajoupa-Bouillon, route de Fonds-St-Denis aux Deux-Choux et de là au Calvaire, *Duss 3969* (ex Duss).

A Mexican species which is well known in cultivation. It may have been confused with the West Indian *S. substipitata.*

SELAGINELLA MNIOIDES (Sieber ex Hook. & Grev.) Spring.

GUADELOUPE. *L'Herminier* (K).

The specimens at Kew are mixed with *S. substipitata* and probably never came from Guadeloupe. Sieber's *Fl. mixta 325*, stated to have been from Mauritius by Spring (Mém. Acad. R. Belg. xxiv: 223 (1850)), was actually from Trinidad, collected by Wrbna, according to A. Braun (Index Sem. Hort. Bot. Berol., App.: 23 (1860)).

SELAGINELLA PORELLOIDES (Lam.) Spring.—Duss, Fl. Crypt. Antill. Franç.: 126 (1904).

GUADELOUPE. Massif de Houëlmont, Vieux-Fort (cafeyères au pied du morne Pavillon), Vieux-Habitants (environs de l'habit. La Grivellière), &c., *Duss 3881* (ex Duss).

MARTINIQUE. Bois entre le camp Colson et le camp de l'Alma, environs des Deux-Choux (plateau Chou), *Duss 4103* (ex Duss).

A species found in Trinidad and Guiana. The Lesser Antillean records probably refer to *S. tenella.*

A NEW SPECIES OF *CHEILANTHES* FROM AFRICA AND SOME ADDITIONS TO THE FERN FLORA OF NORTHERN RHODESIA

By A. H. G. ALSTON

A SMALL collection of ferns made by Mr. E. Milne-Redhead, which was sent for naming from the Royal Botanic Gardens, Kew, included a striking new species of *Cheilanthes* and several species which had not been previously recorded from the area.

The area, which is near the junction of Northern Rhodesia, Angola and the Belgian Congo, is evidently of exceptional interest.

Cheilanthes angustifrondosa Alston, sp. nov. (Plate 2).

Species inter africanas insignis, ex affinitate *Cheilanthei fragilis* Hook. et aliarum specierum asiaticarum; a *C. fragili* glabritie stipitis, squamis bicoloribus et pinnulis acutioribus facile distinguitur; rhizomatibus breviter repentibus stipitibus crebre caespitosis apicem versus indutis; squamis anguste linearibus fusco-castaneis, albo-marginatis, subintegris; frondibus bipinnatis, ambitu anguste oblongo-linearibus, 35–50 cm. longis, usque ad 6 cm. latis, stipitibus 3–10 cm. longis; rachidibus purpureo-castaneis, dorso applanatis, glabris et nitentibus vel basin versus sparse squamulosis, usque ad 2 mm. diametro; pinnis suboppositis c. 18 utroque latere basin versus pinnatis, pinnula apicali profunde pinnatifida; pinnulis c. 8 mm. longis, 2·5 mm. latis, oblongo-triangularibus, leviter falcatis, utrinsecus omnino glabris, nervis immersis, subtus glauco-viridibus, supra obscure viridibus; nervis pinnatim ramosis, nervulis lateralibus simplicibus vel furcatis; indusiis subsemilunulatis, glabris, margine sinuatis; sporis subtrigonis, sublaevibus.

NORTHERN RHODESIA. Kalambo Falls, Abercorn, 29 Mar. 1947, *van Meel 1369* (BM).

ANGOLA. District of Moxico: towards the top of a hill, south of Lusavo Falls, in *Brachystegia-Isoberlinia* woodland on sand near rocky outcrop, 12 Jan. 1938, *Milne-Redhead 4074* (K, type; BM).

BELGIAN CONGO. District du Haut-Katanga: Sub-Distr. Sakania: Luente, N.N.W. of Kiniama, under trees, 24 Feb. 1908, *Kassner 2496* (BM; K).

A remarkable new African species which seems to represent the small Asiatic group of *C. fragilis* and its allies. A search in the herbaria at the British Museum and Kew brought to light some fragmentary specimens collected by Kassner and van Meel.

Thelypteris guineensis (Christ) Alston, comb. nov.

Dryopteris guineensis Christ in Journ. de Bot. xxii: 22 (1909).

NORTHERN RHODESIA. Mwinilunga District: in dense shade of evergreen vegetation by R. Matonchi near dam, 6 Nov. 1937, *Milne-Redhead 3131* (K).

ANGOLA. District of Lunda: Falls of Rio Chiumbe, Dala, *Carrisso & Mendonça 567* (BM).

FRENCH GUINEA. Labé, *Chevalier 12385* (type; BM, photo).

A rare species previously recorded only from the original collection from French Guinea.

ASPLENIUM FORMOSUM Willd.

NORTHERN RHODESIA. Mwinilunga District: among moss on the trunks in evergreen vegetation by R. Matonchi below dam, 19 Oct. 1937, *Milne-Redhead 2849* (K). Camp 17 west of R. Lunga, rocks in river in shade near the water level, 12 Sept. 1930, *Milne-Redhead 885* (K).

DORYOPTERIS PILOSA (Poir.) Kuhn.

NORTHERN RHODESIA. Mwinilunga District: Luakera Falls, north of Mwinilunga, on and by rocks on slope in open *Brachystegia* woodland, 25 Jan. 1938, *Milne-Redhead 4351* (K).

A species previously known only from Réunion, with a doubtful record from Mauritius (*Commerson* (K)). The Rhodesian specimens are not absolutely identical with those from Réunion, but it seems inadvisable to separate them in the present state of our knowledge.

ELAPHOGLOSSUM SPATHULATUM (Bory) Moore.

NORTHERN RHODESIA. Mwinilunga District: Luakera Falls, north of Mwinilunga, on mossy rocks in shade of evergreen vegetation by river, 25 Jan. 1938, *Milne-Redhead 4334* (K).

OPHIOGLOSSUM COSTATUM R. Br. (*O. fibrosum* Schumach.).

NORTHERN RHODESIA. Mwinilunga District: Kalenda Dambo, in moist peaty shallow soil overlying 'laterite', 14 Feb. 1938, *Milne-Redhead 4567* (K).

Ophioglossum pedunculosum Desv. is clearly the same, as is shown by a photograph in the British Museum Herbarium, and the species has recently been described again as *O. fenixii* Tardieu. Clausen's monograph (Mem. Torr. Bot. Club xix: 140 (1938)) confuses this plant with South African specimens which lack the characteristic bulbous rootstock and conspicuous pale median band of the leaves. *O. sarcophyllum* Desv. seems to be the correct name for the South African plant.

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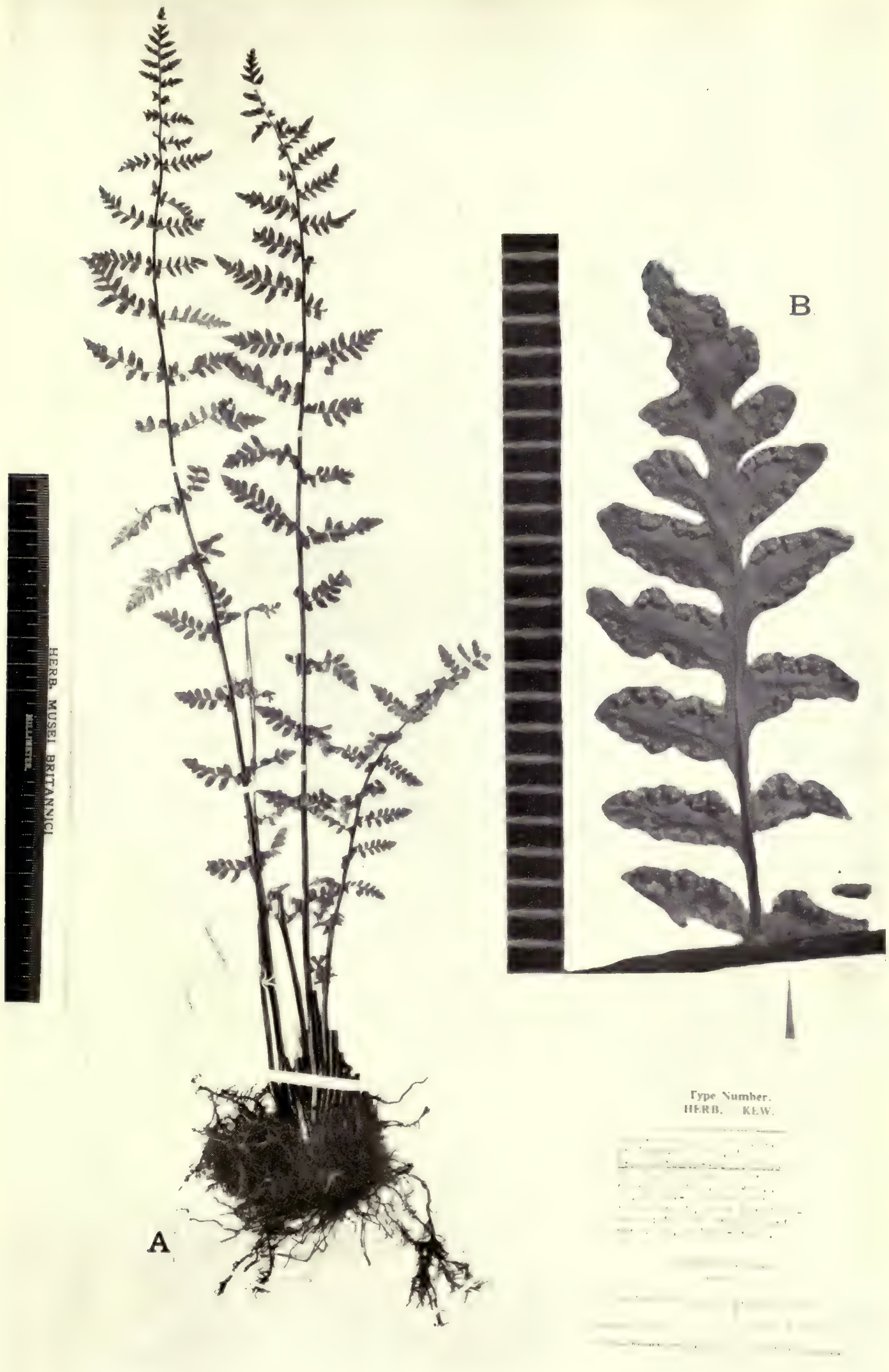
PLATE 2

Cheilanthes angustifrondosa. A. Entire plant (about $\frac{1}{3}$ nat. size). B. Pinna ($\times 4\frac{1}{2}$).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NOTES ON PODOSTEMACEAE

FOR THE REVISION OF THE *FLORA OF WEST TROPICAL AFRICA*

G. TAYLOR

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 1 No. 3
LONDON : 1953

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Pp. 51–79; 14 Text-figures

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NOTES ON PODOSTEMACEAE FOR THE REVISION OF THE *FLORA OF WEST TROPICAL AFRICA*

By G. TAYLOR

THIS account contains descriptions of the new genera and species which will be included in the revised edition of Hutchinson and Dalziel's *Flora of West Tropical Africa*, also notes on some other species of the family.

The treatment of the *Podostemaceae* in the first part of the *Flora of West Tropical Africa*, published in 1927, recognized only two genera, each with one species, but in the intervening years our knowledge of the family has grown astonishingly, and now, as the result of recent collecting in British and French-controlled territory, the representation of the family in the new edition will be increased to 6 genera, with a total of 18 species.

It is evident that the highest density of genera and species is in the rain-forest countries around the Gulf of Guinea and, as the available specimens indicate that there is a high degree of local endemism in the family, there is little doubt that the rivers of West Africa will yet yield a rewarding harvest of new species.

Some species are extremely variable, and seasonal variations and abrasion in the austere habitat obscure and sometimes destroy differential characters. It is possible that modifications or states of one plant have been distinguished as species, and when further material at all seasons is obtained, some adjustment of the present classification may be necessary.

A monographic study of the African *Podostemaceae* is in preparation, and in that work discussion of generic limits and affinities will be developed.

In preparing this account I have had the advantage of the loan of material from the Paris Museum of Natural History, from Professor H. des Abbayes of the University of Rennes, from the Berlin Botanical Garden, and from the Botanic Museum and Herbarium, Utrecht. Finally, the splendid collections of herbarium and spirit specimens made by Mr. R. W. J. Keay and his associates in Nigeria and the British Cameroons, which are preserved at Kew, have been placed freely at my disposal. I wish to thank the Directors of these institutions and those who have allowed me to examine the specimens and so prepare such a full treatment of the family for the forthcoming volume.

Pohliella flabellata G. Tayl., sp. nov. (Fig. 1).

Herba caulescens usque ad 21 cm. longa, thallo radicali saxis adhaerens; caules fluitantes pseudo-dichotomi, paullum compressi. *Folia* fluitantia, ambitu flabellata, pluries dichotoma, usque ad 3 cm. longa et 2 cm. lata, basi vaginata, segmentis primariis anguste linearibus, laciniis ultimis capillaribus. *Spathellae* ex thallo radicali

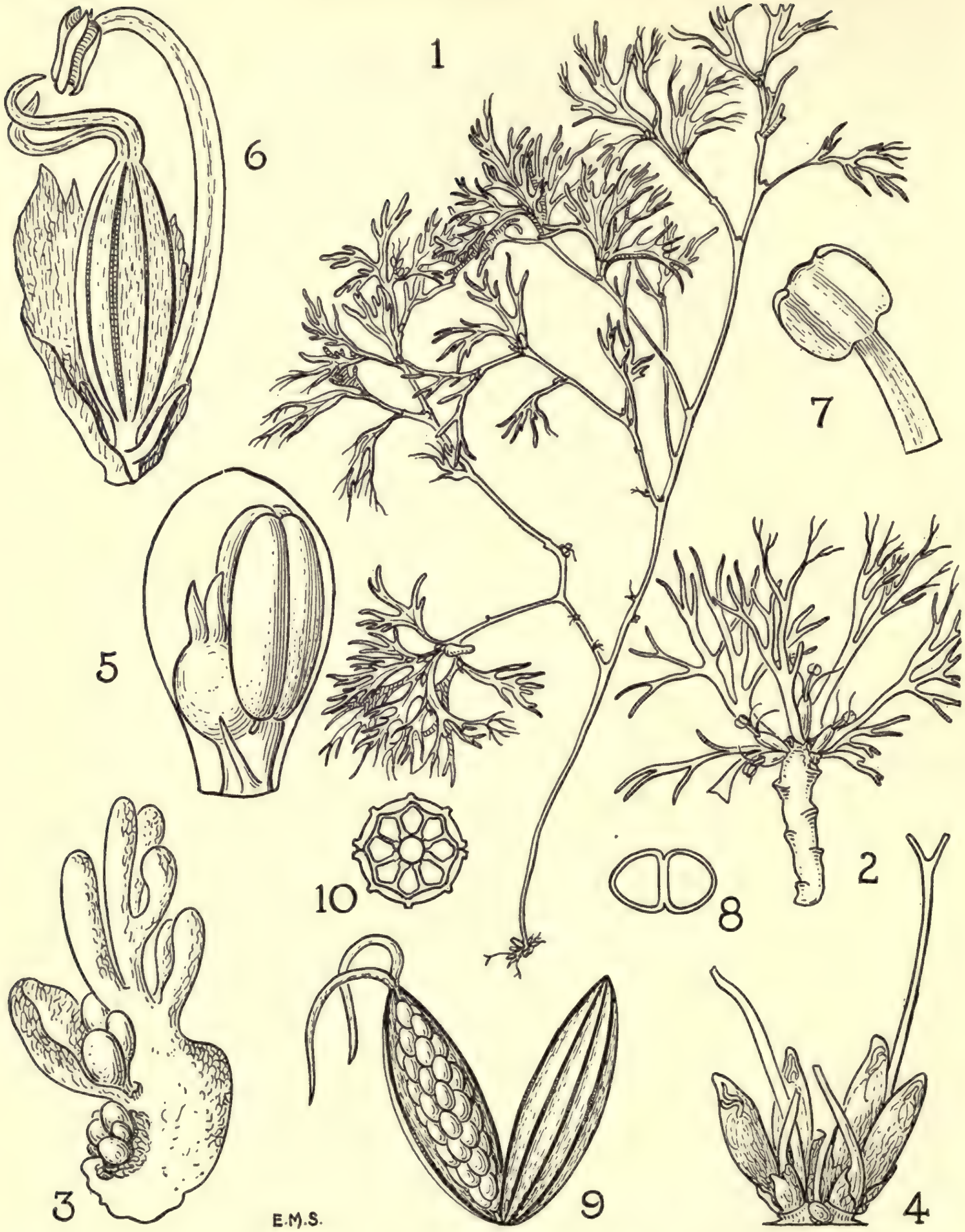

FIG. 1. *Pohliella flabellata* G. Tayl.

1. Plant showing habit (× $\frac{2}{3}$). 2. Flowering shoot (× 2). 3. Portion of thallus with young shoots and spathellae (× 20). 4. Group of spathellae (× 20). 5. Flower within unruptured spathella (× 40). 6. Mature flower (× 16). 7. Anther (× 30). 8. Pollen-grain (× 300). 9. Dehisced capsule (× 16). 10. Section of ovary (diagrammatic).

emergentes etiam ramulorum floriferorum apicem versus in foliorum axillis gestatae, anguste ellipsoideae, c. 1 mm. longae. *Flos* in spathella brevissime pedicellatus, erectus. *Tepala* 2, subulata, c. 0·3 mm. longa. *Stamen* 1; filamentum demum 4·5 mm. longum; anthera c. 0·5–0·75 mm. longa et 0·5 mm. lata, in spathella accumbens; pollen bicellulare. *Ovarium* primum globosum, deinde ellipsoideum, c. 3·5 mm. longum, 8-costatum costis 2 commissuralibus duplicibus; gynophorium 0·25 mm. longum; stigmata 2, subulato-filiformia, c. 2 mm. longa, persistentia. *Capsula* ellipsoidea, bivalvis, c. 3·5 mm. longa et 1 mm. lata; valvae aequales, praeter costas marginales 3-costatae.

NIGERIA. Ogoja Province: by the Aboabam–Boje path crossing the Afi River, aquatic herb forming dense masses on rocks below water; thallus green, blotched crimson; 13 Dec. 1950, *Keay FHI. 28240* (Herb. Kew, holotype; Herb. Brit. Mus.).

Apart from differences in habit and shape of the stigmas, I am not satisfied that the key characters used by Engler to distinguish *Pohliella* from *Saxicolella* are sufficiently diagnostic. The number of ribs on the capsule—whether 6 or 10—is probably unreliable in this group, and it is almost impossible, without careful microtome sections of young flower-buds, to decide whether the ovary has one or two loculi. I have placed this species in *Pohliella* on account of its subulate stigmas and repeatedly dichotomously branched leaves. It deviates from the generic definition in having, as far as I have been able to ascertain, a unilocular ovary. I have described the capsule of *P. flabellata* as having 8 ribs, of which the 2 commissural ribs, in the plane of dehiscence, are double, but judging from the description and figure given by Engler (in Engl. & Drude, Veg. Erde ix, 3, 1: 271, fig. 177 (1915) as *Inversodicraea laciniata* Engl.), he would consider the capsule to be 10-ribbed.

Butumia G. Tayl., gen. nov. inter genera tribus *Podostemearum*[1] gemmis ad marginem thalli angusti ramosi dispositis, foliis rosulatis, floribus in spathella erectis, stigmatibus complanatis distinctum.

Spathellae ovoideae, minute apiculatae. *Flos* in spathella breviter pedicellatus, erectus. *Tepala* 2, minuta. *Stamen* 1, in spathella accumbens; pollen bicellulare. *Ovarium* ellipsoideum, 8-costatum, costis 2 commissuralibus duplicibus; gynophorium brevissimum; stigmata 2, complanata, ambitu elliptica, divergentia, persistentia. *Capsula* late ellipsoidea, bivalvis; valvae aequales, praeter costas marginales 3-costatae.

Herba pusilla acaulis; thallus radicalis angustus, ramosus, margine utrinque gemmas minimas gerens; gemmae sessiles, 1-florae. *Folia* rosulata, sessilia, subulata, basi leviter amplexicaulia, interiora florem subtendentia, minute stipulata.

Species 1, in west tropical Africa. Type: *B. marginalis* G. Tayl.

Butumia marginalis G. Tayl., sp. nov. (Fig. 2).

Thallus c. 1·5 mm. latus. *Gemmae* sub anthesin usque ad 1·25 mm. altae. *Folia* c. 1 mm. longa. *Spathellae* 1 mm. longae. *Pedicellus* demum c. 1 mm. longus. *Staminis* filamentum demum c. 1·2 mm. longum; anthera c. 0·5 mm. longa. *Ovarium* 1 mm. longum et 0·75 mm. latum.

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[1] PODOSTEMEAE = *Eupodostemeae* Benth. in Benth. & Hook., Gen. Pl. iii: 107 (1862), *nom. illegit.*

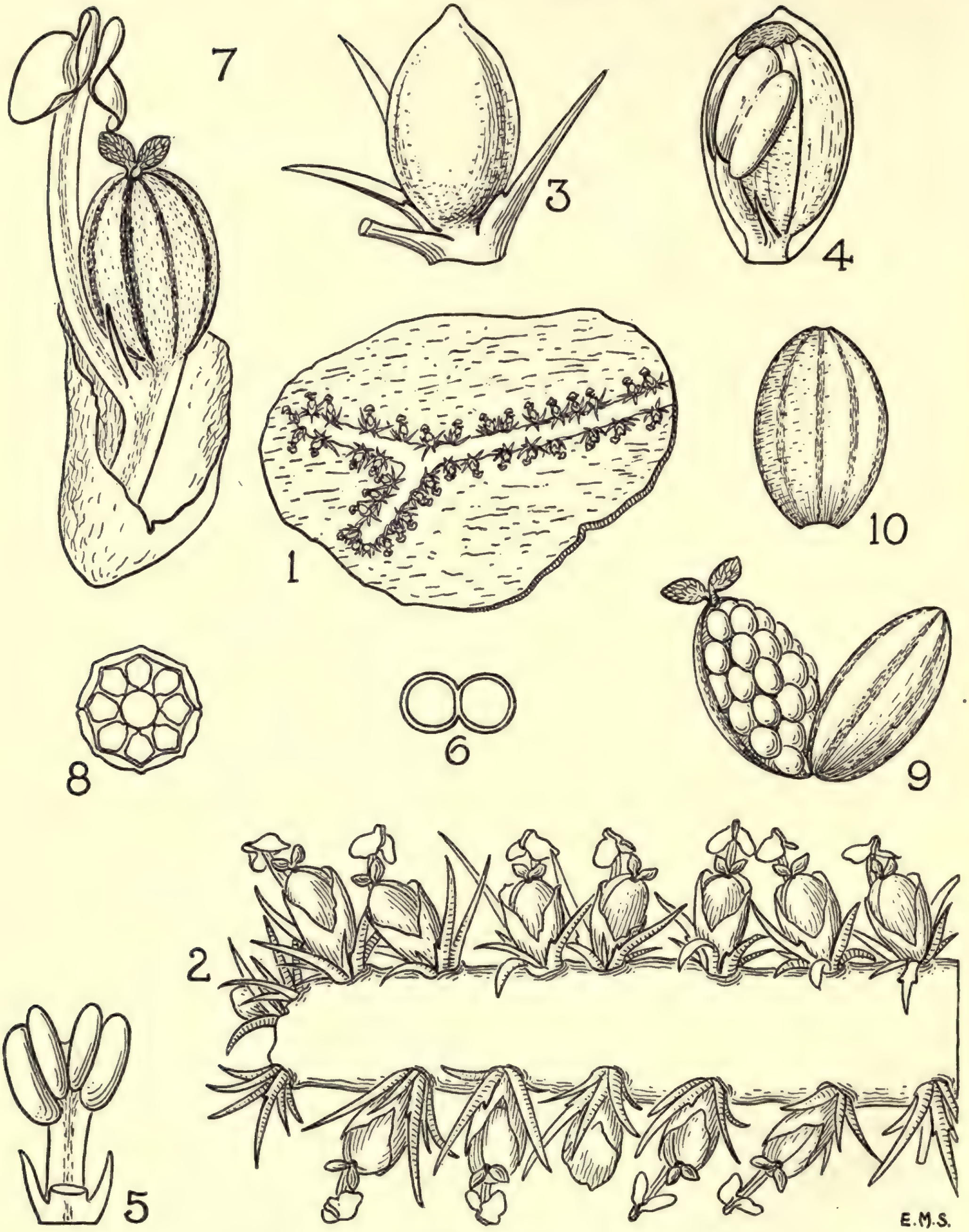

FIG. 2. *Butumia marginalis* G. Tayl.

1. Habit on rock (× 2). 2. Portion of thallus with flowers (× 10). 3. Young flowering shoot (× 28). 4. Flower within unruptured spathella (× 28). 5. Stamen and tepals (× 28). 6. Pollen-grain (× 350). 7. Mature flower (× 28). 8. Section of ovary (diagrammatic). 9. Dehisced capsule (× 28). 10. Capsule valve (× 28).

NIGERIA. Ogoja Province: River Butum, Utanga, about 3 km. north of Bagga, on smooth granite rocks, just below, at, and just above water-level in fast-flowing stream; moss-like plant in small rosettes with reddish central thallus, often several connected by a red thread-like 'stolon'; 25 Dec. 1948, *Keay, Savory & Russell FHI. 25152* (Herb. Kew, holotype; Herb. Brit. Mus.).

This plant cannot suitably be referred to a described genus and yet it is not distinguishable by any prominent diagnostic feature but rather by a combination of characters. The species is strikingly similar in habit to *Inversodicraea minima* Engl. from South Cameroons, but it differs basically in having the flower erect within the spathella. The one-flowered shoots (with entire rosulate leaves) arranged along the margin of the thallus, the flowers erect within the spathella and with a single stamen, the short pedicel and the complanate stigmas, collectively justify generic rank. Amongst African genera the plant is most closely related to *Saxicolella* and *Pohliella*, in each of which the flower is unistaminate and erect within the spathella, but it differs from these genera in having entire rosulate leaves, much more shortly pedicellate flowers and complanate stigmas. *Butumia* may also be related to *Polypleurella*, a monotypic genus in Siam. The two genera have one-flowered shoots borne at the margins of a branched hepatic-like thallus, but in *Polypleurella* the leaves are distichous, the subulate tepals equal the androecium, and the styles are subulate.

The genus is named after the river in which it is found.

Letestuella G. Tayl., gen. nov. inter genera tribus *Podostemearum* floribus in spathella inversis, capsulis globosis laevibus (haud costatis) distinctum.

Spathellae fusiformi-ellipsoideae, basi breviter vel longe stipitatae. *Flos* in spathella pedicellatus, erectus. *Tepala* 2, minuta. *Stamina* 1–2, in spathella accumbentia; pollen unicellulare. *Ovarium* globosum, praeter sulcum commissuralem laeve; gynophorium brevissimum; stigmata 2, clavata, in spathella antheras versus deflexa. *Capsula* globosa, bivalvis; valvae aequales, ecostatae, nitidae.

Herbae caulescentes, ramosae. *Folia* integra vel plerumque 1–3-bifida, laciniis anguste linearibus, basi leviter amplexicaulia, minute stipulata vel exstipulata.

Species 2, in west tropical Africa. Type: *L. tisserantii* G. Tayl.

In naming this genus *Letestuella* I wish to commemorate M. Georges Le Testu who has made extensive botanical explorations in French Equatorial Africa and whose large collections of *Podostemaceae* include a number of new species yet to be described.

Letestuella tisserantii G. Tayl., sp. nov. (Fig. 3).

Herba longitudine 5 cm. attingens. *Folia* disticha, in caulis parte inferiori cataphyllaria, minuta, amplexicaulia; folia superiora 1–3-bifida, usque ad 4 cm. longa. *Spathellae* c. 3·5 mm. longae, post anthesin campanulatae apice laceratae interdum revolutae. *Pedicellus* c. 2 mm. (post anthesin usque ad 6·5 mm.) longus. *Stamina* 1 (tumque filamento c. 1·2 mm. longo) vel 2 (tumque andropodio 1·4 mm. longo filamentis brevissimis). *Ovarium* c. 1·2 mm. diametro.

UBANGI-SHARI. Rocks in the River Baedou, Zubingui, 29 Nov. 1927, *Tisserant* in

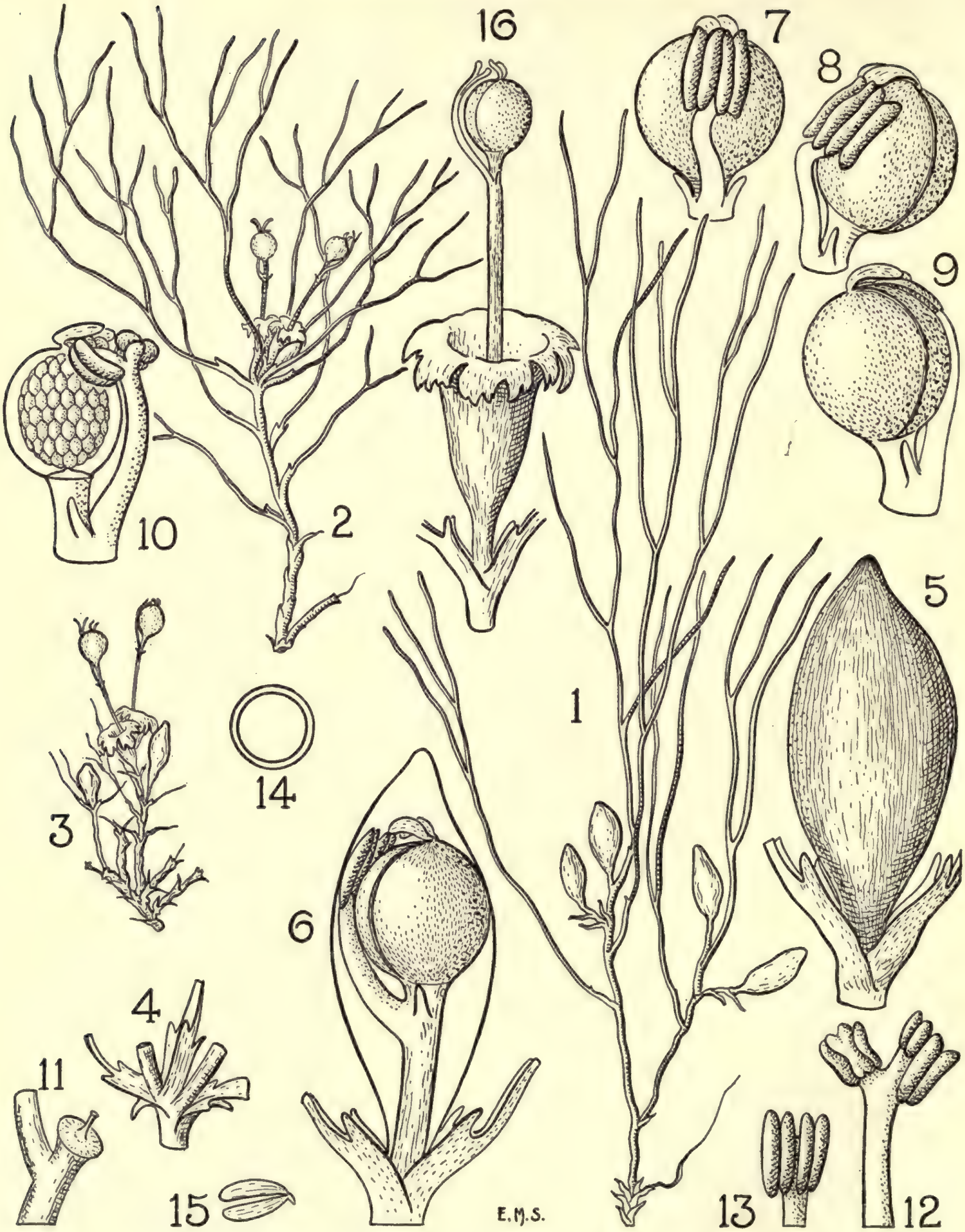

FIG. 3. *Letestuella tisserantii* G. Tayl.

1. Plant showing habit (×3). 2, 3. Flowering shoots (×3). 4. Node (×8). 5. Spathella (×16). 6. Flower within unruptured spathella (×16). 7, 8, 9, 10. Flowers removed from spathellae (×16). 11. Receptacle (×16). 12, 13. Stamens (×16). 14. Pollen-grain (×660). 15. Stigmas (×16). 16. Infructescence (×8).

Herb. Le Testu 1769 (Herb. Le Testu, holotype; Herb. Brit. Mus.); on rocks on an island in the River Baedou, 25 km. south of Ippy, 29 Nov. 1927, *Tisserant* in *Herb. Le Testu 2352* (Herb. Le Testu; Herb. Brit. Mus.).

Letestuella chevalieri G. Tayl., sp. nov.

Leiothylax sphaerocarpa[1] sensu A. Chev., Fl. Viv. Afr. Occ. Franç. i: 295 (1938) pro parte; non Engl.

Herba tenuiter caulescens, ramosa, ut videtur 3·5 cm. attingens. *Folia* anguste linearia, integra vel breviter bifida, laciniis anguste linearibus, usque ad 2 cm. longa, basi leviter dilatata et vaginata. *Spathellae* ad caulium apices dispositae, in fructu longe stipitatae stipite usque ad 1 cm. longo. *Pedicellus* in fructu c. 1 cm. longus. *Tepala* minutissima, subulata. *Stamina* 2; filamenta cum andropodio persistenti c. 1·5 mm. longa. *Gynophorium* 0·5 mm. longum. *Ovarium* in spathella verisimiliter erectum. *Capsula* globosa, laevis, nitida, bivalvis, 1 mm. diametro; stigmata decidua; valvae aequales, ecostatae.

FRENCH SUDAN. Falls of the Niger, 23 Mar. 1932, *Chevalier 44058 bis* (Herb. Paris, holotype).

The material of this species which I have examined is rather fragmentary and too mature for adequate description of the spathellae and flower structure. The floral details given have been derived from persistent remnants on the few fruiting specimens available and also from two somewhat mutilated spathellae which had failed to develop properly. On that account they may have been slightly abnormal, but in each the ovary appeared to be erect and the spathella only recently ruptured. This observation requires to be confirmed from examination of younger material, but, for the present, it is desirable to recognize the plant as a second species of *Letestuella*, with which it agrees in all other important particulars.

Stonesia G. Tayl., gen. nov. inter genera tribus *Podostemearum* staminodio inter filamenta posito, capsula leviter compressa, 12–18-costata, eis ad commissuras approximatis brevioribus capsulae extremitates non attingentibus valde distinctum.

Spathellae subobovoideae vel ellipsoideae secus caules elongatos dispositae, atque nonnunquam in thallo radicali sessiles tumque interdum a dorso complanatae sublenticulares thallo accumbentes. *Flos* in spathella inversus, pedicello brevior. *Tepala* 2, filiformia. *Stamina* 2, andropodio filamenta subaequanti; staminodium subulatum inter filamenta positum. *Ovarium* ellipsoideum vel subglobosum, multicostatum; gynophorium brevissimum vel subnullum; stigmata 2, brevissima vel filiformia, divergentia. *Capsula* late ellipsoidea vel subglobosa, leviter compressa, multicostata, bivalvis; costis 12–18, eis ad commissuras approximatis brevioribus capsulae extremitates non attingentibus; valvae subaequales, 6–9-costatae, altera persistens, altera decidua.

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[1] I have examined material cited by Engler (*Ledermann 2894* in the Berlin Herbarium) when he originally described *Leiothylax sphaerocarpa*, and the flower within the spathella is inverted and there is a single stamen. Furthermore, the globose capsule has broad but inconspicuous longitudinal bands. These characters indicate that the species should be referred to *Sphaerothylax*, thus:

Sphaerothylax sphaerocarpa (Engl.) G. Tayl., comb. nov.

Leiocarpodicraea sphaerocarpa Engl. in Engl. & Drude, Veg. Erde ix, 3, 1:275 (1915).

Leiothylax sphaerocarpa (Engl.) Engl. in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, xviiia: 58 (1930).

Herbae thalloideae et caulescentes; caules elongati, ramosi. *Folia* raro integra, plerumque bifida ad multifida, segmentis linearibus.

Species 3, in west tropical Africa. Type: *S. heterospathella* G. Tayl.

Stonesia is at once distinguished from all other African *Podostemaceae* by three well-defined floral characters: (i) the presence of a staminode inserted between the two functional stamens (this is a feature of a number of extra-African species, and it is found in *Podostemum ceratophyllum* Michx., a native of temperate North America and the type of the family); (ii) the number of ribs on the slightly compressed capsule varies from 12 to 18 (in other African genera it is not known to exceed 10); (iii) the ribs nearest to the commissures do not run the length of the capsule along the commissures but begin on the commissure above the base and, curving parallel to the other ribs, rejoin the commissure below the apex. The type species, *S. heterospathella*, also possesses unusual features in having dimorphic spathellae of which each sort is of a type apparently unknown in other genera. This remarkable dimorphism may not be exceptional, and clearly shows the need for thorough and knowledgeable collecting of these plants, otherwise unnecessary duplication of species may result from the description of different parts of the same plant.

This distinct genus of three species is decidedly circumscribed in its present known distribution, and is confined to a small region of French Guinea where two of the species apparently grow in association.

In naming this genus *Stonesia* I wish to express my deep gratitude to Miss Margaret Stones, whose beautiful illustrations, completed with infinite care and patience, have been of the utmost value in elucidating the microscopical floral structure of these remarkable plants.

Stonesia heterospathella G. Tayl., sp. nov. (Figs. 4 and 5).

Dicraeia[1] *garrettii* sensu A. Chev., Explor. Bot. Afr. Occ. Franç.: 539 (1920).—Hutch. & Dalz., Fl. W. Trop. Afr. i: 108 (1927) pro parte; non C. H. Wright.

Dicraeanthus parmelioides A. Chev., Fl. Viv. Afr. Occ. Franç. i: 294, fig. 43B (1938), *nom. nud.* (descr. gall. tantum).

Herba thallo radicali saxis adhaerens; caules elongati, steriles vel floriferi, pluries dichotomi, ex thallo emergentes, usque ad 12 cm. longi. *Folia* laciniata; laciniae superiores demum basibus persistentibus segmentorum ultimorum munitae. *Spathellae* dimorphae; eae ex thallo emergentes solitariae, unibracteatae, difformes, a dorso complanatae, sublenticulares et thallo accumbentes, margine incrassata cartilaginea circumdatae alibi membranaceae, demum crateriformes margine involutae, bractea

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[1] I have adopted the original spelling of Thouars (Gen. Nov. Madag.: 2 (1806)). Steudel, in the second edition of his *Nomenclator Botanicus* (i: 505 (1840)) reduced *Dicraeia* to *Lacis* Schreb. under the specific name *L. Dicraea* Steud., and in doing so altered the spelling to *Dicraea*.

Tulasne, in his *Podostemacearum Synopsis Monographica* (in Ann. Sci. Nat., Sér. 3, Bot. xi: 100 (1849)), accepted the spelling *Dicraea* which he considered preferable on account of the derivation from *δίκραιος* (forked, cleft). Thouars, however, was quite at liberty to choose the spelling *Dicraeia*, though it may be the poorer form philologically. Technically the name *Dicraeia* is an illegitimate substitute for *Podostemum* Michx. which is cited by Thouars.

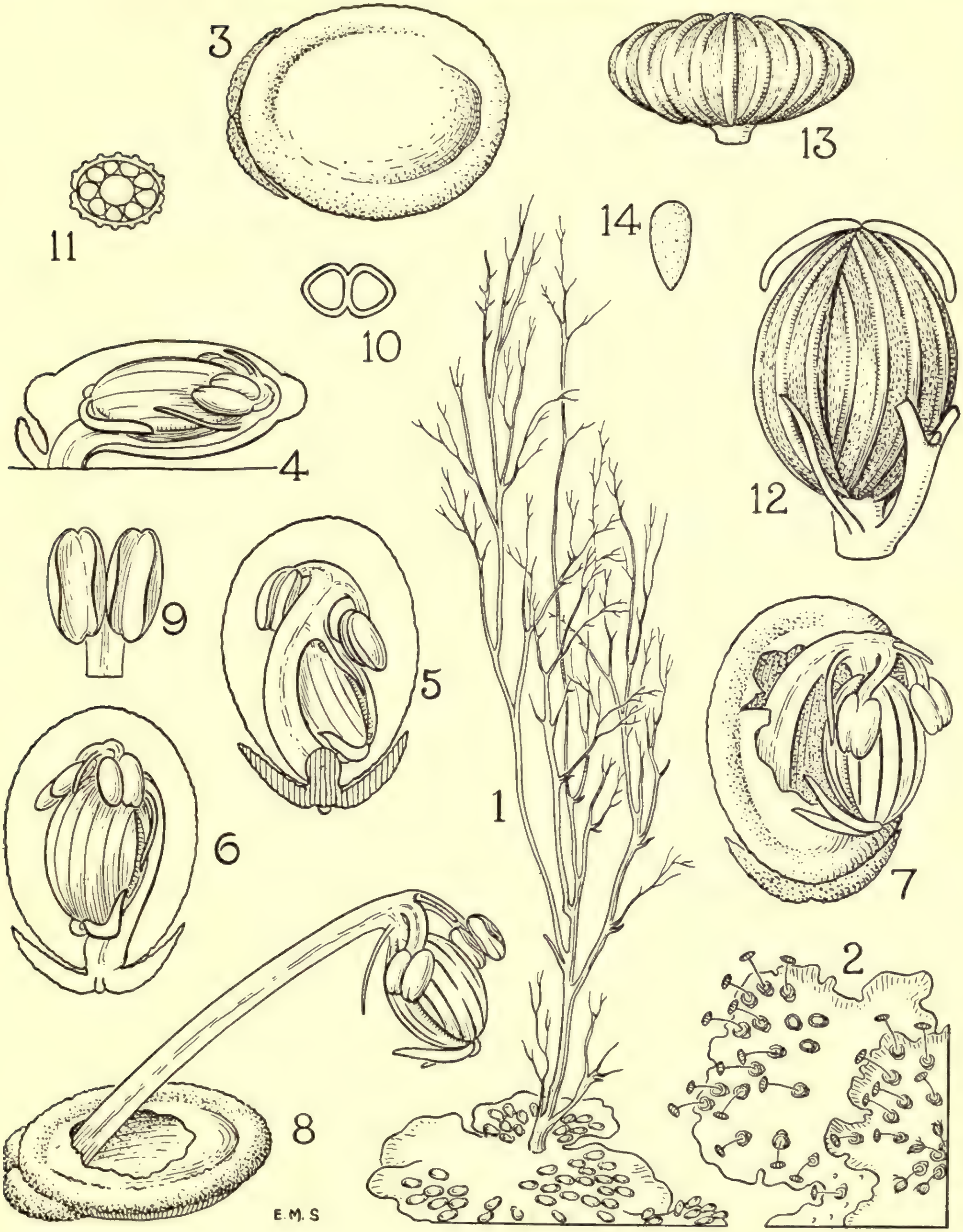

FIG. 4. *Stonesia heterospathella* G. Tayl.

1. Plant showing habit (×1½). 2. Fruiting specimen (×1½). 3. Unruptured spathella on the thallus (×20). 4. Vertical section of spathella on thallus (×20). 5. Ventral view of spathella on thallus (×20). 6. Dorsal view of spathella on thallus (×20). 7. Flower emerging from spathella (×20). 8. Mature flower (×20). 9. Anther (×40). 10. Pollen-grain (×400). 11. Section of ovary (diagrammatic). 12. Young fruit (×40). 13. Persistent capsule valve (×40). 14. Seed (×40).

squamiformi concava persistenti juxta spathellae basin posita, c. 2 mm. longae; eae in caulibus elongatis axillares, juventute glandiformes, involucellatae, haud compressae, basi bibracteatae (bracteis anguste linearibus, c. 1 mm. longis, mox deciduis), c. 1·5 mm. longae. *Flos* per anthesin 1·5 mm. altus; pedicellus c. 1·5 mm. longus, apice curvatus, demum erectus et usque ad 4 mm. longus. *Tepala* 0·5 mm. longa. *Staminum* filamenta 0·3 mm. longa; antherae 0·4 mm. longae et 0·4 mm. latae; pollen bicellulare; staminodium 0·3 mm. longum; andropodium brevissimum. *Ovarium* late ellipsoideum, 1 mm. longum, brevissime stipitatum; stigmata anguste filiformia, 0·5 mm. longa, divergentia. *Capsula* subglobosa vel late ellipsoidea, costis 12–18; valvae 6–8-costatae, altera persistens in sicco fortiter inflexa.

FRENCH GUINEA. High plateau between Ditinn and Diaguissa, April 1905, *Chevalier 12842* (Herb. Paris; Herb. Brit. Mus.); on rocks lapped by water and in spray in a natural basin at the foot of the great falls, Ditinn (circle of Dalaba), about 720 m., 14 Nov. 1948, *des Abbayes 877/1948* (Herb. Brit. Mus., holotype; Herb. Univ. Renn.; Herb. Utrecht); same locality and date, *des Abbayes 887/1948* (Herb. Brit. Mus.; Herb. Univ. Renn.); rocks in the current immediately below the great fall, falls of the Kinkon, Pita, 880 m., 22 Nov. 1948, *des Abbayes 897 bis/1948* (Herb. Brit. Mus.; Herb. Univ. Renn.; Herb. Utrecht); same locality and date, on flat rocks in the current, in shallow water or exposed at time of flowering, *des Abbayes s.n.* (Herb. Brit. Mus.; Herb. Univ. Renn.).

I have not examined the specimen (*Chevalier 20231*) originally identified by Chevalier as *Dicraeia garrettii* and cited by him in 1920, and, though not seen by the authors, accepted by Hutchinson and Dalziel in the *Flora of West Tropical Africa*.

This species is exceptional in producing two kinds of spathellae of very different appearance. The more primitive type, borne in the axils of leaves on the much-branched shoots, look when young like miniature acorns and are subtended by two linear deciduous bracts. The inner spathella containing the embryonic flower bursts through the enveloping involucel which persists at the base of the miniature inflorescence as a small cushion. On the thallus, the spathellae are remarkably characteristic and, if they had not been found in association with branches bearing the other type, would certainly have provided characters for generic separation in a family where generic distinctions are sometimes rather fine. These spathellae on the thallus of *S. heterospathella* are subtended by a scale-like, persistent, somewhat crescent-shaped bract. They are dorsally compressed with a cartilaginous ring around the margin. The developing flower bursts through the abaxial face of the spathella which becomes crateriform in appearance with an inrolled margin.

In most of the specimens of this species which I have examined, the material is either only thalloid with a few sterile branches or of fertile branches devoid of a broad thalloid base. Two specimens, however, provided evidence that the extraordinarily different spathellae, which were at first thought to belong to two distinct species, were produced on the same plant.

Chevalier referred this plant to *Dicraeanthus*, a monotypic genus of different and very distinctive habit having, among other divergent characters, linear-oblong capsule valves with 5 ribs.

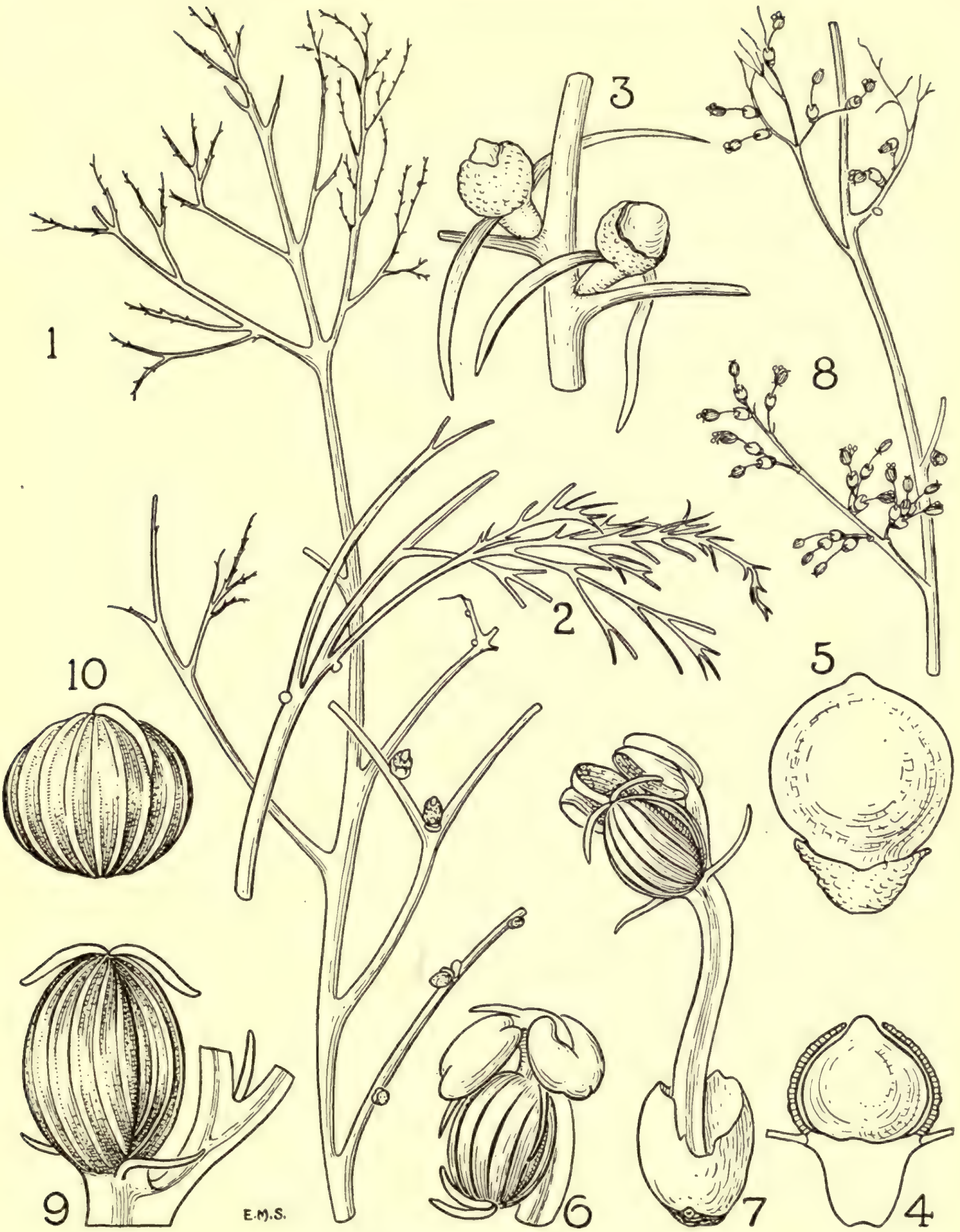

FIG. 5. *Stonesia heterospathella* G. Tayl.

1. Branch with spathellae (× 1½). 2. Branch with laciniate leaves (× 2). 3. Spathellae with linear bracts (× 20). 4. Longitudinal view of young spathella (× 40). 5. Spathella shortly before anthesis (× 20). 6. Young flower removed from spathella (× 20). 7. Mature flower (× 15). 8. Shoot and fully developed flowers (× 1½). 9. Fruit (× 30). 10. Persistent valve of capsule (× 30).

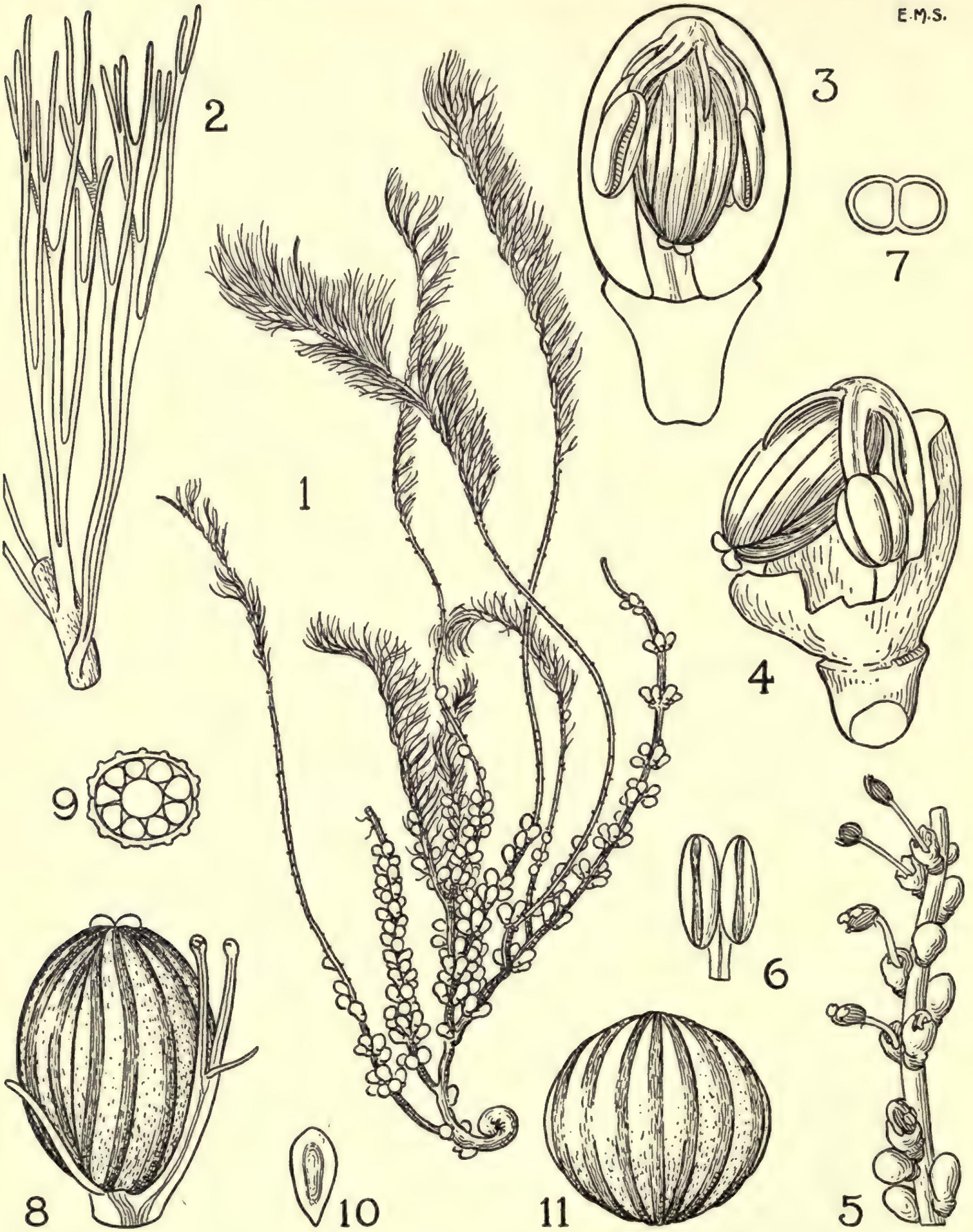

FIG. 6. *Stonesia fascicularis* G. Tayl.

1. Plant showing habit (× 1). 2. Leaves (× 6). 3. Flower within unruptured spathella (× 20). 4. Flower emerging from spathella (× 20). 5. Portion of stem with mature flowers (× 2). 6. Anther (× 20). 7. Pollen-grain (× 400). 8. Young fruit with persistent tepals and androecium (× 30). 9. Section of ovary (diagrammatic). 10. Seed (× 40). 11. Persistent capsule valve (× 30).

According to Chevalier's description, *S. heterospathella* forms thin crusts, from 7 to 15 cm. across, with the thallus irregularly lobed at the margin and the rounded lobes 2 cm. in diameter.

Stonesia fascicularis G. Tayl., sp. nov. (Fig. 6).

Herba caulescens, usque ad 36 cm. longa; caules elongati in parte inferiori ramosi; rami plerumque simplices, elongati, basin versus floriferi, in parte media demum efoliati sed foliorum basibus parvis persistentibus muniti, apicem versus dense foliiferi. *Folia* usque ad 15 mm. longa, 2–3-bifida, segmentis primariis anguste linearibus, segmentis ultimis capillaribus. *Spathellae* brevissime crasseque pedunculatae, ad nodos efoliatos plerumque basales fasciculares, subobovoideae, c. 2 mm. longae. *Flos* per anthesin c. 1·5 mm. altus; pedicellus c. 2 mm. longus, apice curvatus, demum erectus et usque ad 5 mm. longus. *Tepala* 0·6 mm. longa. *Staminum* filamenta c. 0·6 mm. longa; antherae 0·75 mm. longae et 0·5 mm. latae; pollen bicellulare; staminodium c. 0·5 mm. longum. *Ovarium* sessile, late ellipsoideum, 1·25 mm. longum; stigmata brevissima, c. 0·1 mm. longa, divergentia. *Capsula* late ellipsoidea, c. 14-costata; valvae c. 7-costatae, altera plerumque persistens leviter inflexa.

French Guinea. Pita, falls of the Kinkon, 880 m., on rocks in the current on the edge of the great fall, 22 Nov. 1948, *des Abbayes 897/1948* (Herb. Brit. Mus., holotype; Herb. Univ. Renn.; Herb. Utrecht).

The specific epithet derives from the characteristic clusters of spathellae at the lower nodes of the branches and, as in *S. gracilis*, these floriferous nodes become leafless. Other distinguishing features of *S. fascicularis* are the very small stigmas (only 0·1 mm. long) and the 1–3-bifid leaves which at time of flowering are confined to the uppermost parts of the stems.

Stonesia gracilis G. Tayl., sp. nov. (Fig. 7).

Herba caulescens, 22 cm. attingens; caules ex thallo radicali emergentes, graciles, simplices vel nonnunquam apicem versus parce ramosi. *Folia* ut videtur mox decidua et per anthesin tantum caulium apices versus evoluta, linearia vel filiformia, raro integra plerumque 1–2-bifida, usque ad c. 2 cm. longa. *Spathellae* ellipsoideae, ex thallo radicali emergentes etiam ad nodos approximatos secus caules singulatim vel per 2–3 dispositae, c. 2 mm. longae. *Flos* per anthesin c. 1·8 mm. altus; pedicellus c. 1·8 mm. longus, in parte superiori curvatus, demum erectus et usque ad 4 mm. longus. *Tepala* 0·8 mm. longa. *Staminum* filamenta 0·5 mm. longa; antherae 0·75 mm. longae; pollen bicellulare; staminodium 0·5 mm. longum; andropodium in spathella c. 0·5 mm., demum usque ad 1 mm. longum. *Ovarium* ellipsoideum, 1 mm. longum; stigmata brevia, filiformia, c. 0·3 mm. longa, demum divergentia. *Capsula* ellipsoidea, 14-costata; valvae 7-costatae, altera persistens leviter inflexa.

French Guinea. Great Falls (circle of Kindia), on rocks in torrents splashed by spray and covered when the water is high, 4 Nov. 1951, *des Abbayes 355/1951* (Herb. Brit. Mus., holotype; Herb. Univ. Renn.).

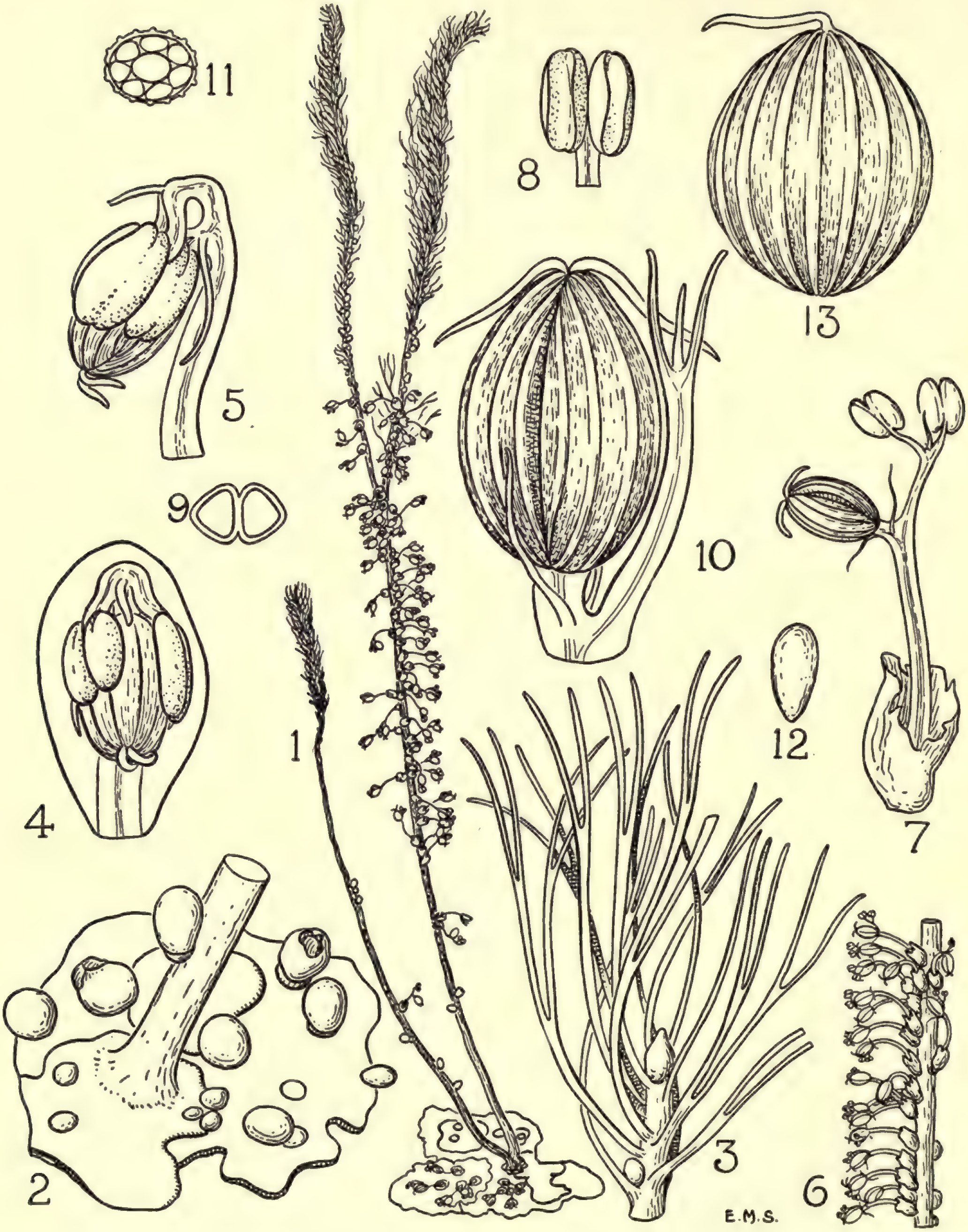

FIG. 7. *Stonesia gracilis* G. Tayl.

1. Plant showing habit (×1). 2. Thallus with base of erect stem and developing spathellae (×6). 3. Apex of stem (×6). 4. Flower within unruptured spathella (×20). 5. Flower removed from spathella (×20). 6. Portion of stem with mature flowers (×2). 7. Flower (×10). 8. Anther (×20). 9. Pollen-grain (×360). 10. Fruit with persistent tepals, androecium and stigmas (×40). 11. Section of ovary (diagrammatic). 12. Seed (×40). 13. Persistent capsule valve (×40).

This species closely resembles *S. heterospathella* in having spathellae both on the basal thallus and on elongated stems, but in the two positions the spathellae are of the same kind and not dimorphic as in the genotype. *S. gracilis* has a very distinctive habit with comparatively long slender stems which occasionally branch sparingly towards the apex and, in mature plants, have plumose tufts of entire or bifid linear leaves confined to the tops of the stems. The stems are otherwise almost bare of leaves and the flowers are usually borne singly, but sometimes in twos and threes, along the lower parts of the stems which have short internodes and apparently soon become almost leafless.

Inversodicraea abbayesii G. Tayl., sp. nov. (Fig. 8).

Herba multiramosa, ut videtur 30 cm. attingens; rami dichotomi, graciles, inferne nudi, in parte media sparse setiferi, ad apicem imbricato-foliosi strobilacei. *Folia* superiora lineari-lanceolata, integra vel 1–3-dentata sed plerumque 3-dentata dente medio longissimo subulato dentibus lateralibus parvis vel minutis, 0·5–1 mm. longa; etiam sub spathellis et in caulium furcis folia rara capillaria petiolo 1 cm. longo, lamina dichotome dissecta 2·5 cm. longa. *Spathellae* sessiles, ad caulium apices singulatim dispositae, ellipsoideae, basi foliis circumseptae, apice umbonatae, per anthesin poculiformes apice irregulariter dentatae, usque ad 3 mm. longae. *Flos* in spathella inversus; pedicellus in spathella 2·75 mm. (demum 7·5 mm.) longus. *Tepala* 2, acicularia, 0·8 mm. longa. *Stamina* 1 vel 2; filamentum in spathella c. 0·5 mm. (per anthesin 1·5 mm.) longum vel filamenta (2) 1·25 mm. longa tumque andropodio 0·75 mm. longo; antherae 1·5 mm. longae; pollen bicellulare. *Ovarium* sessile, cylindraceum vel anguste ellipsoideum, 1·5 mm. longum, leviter 8-costatum costis commissuralibus duplicibus inclusis; stigmata clavata, 0·75 mm. longa, primum antheras versus deflexa, demum decidua. *Capsula* cylindrica, bivalvis, c. 3·5 mm. longa; valvae aequales, praeter costas marginales 3-costatae.

French Guinea. Pita, falls of the Kinkon, 880 m., very abundant attached to rocks in the river below the falls, only the flowers emerging from the water, 22 Nov. 1948, *des Abbayes 898/1948* (Herb. Brit. Mus., holotype; Herb. Univ. Renn.).

Inversodicraea garrettii (C. H. Wright) G. Tayl., comb. nov.

Dicraeia garrettii C. H. Wright in Dyer, Fl. Trop. Afr. vi, 1: 126 (1909); in Hook., Ic. Pl. xxxi: t. 3042 (1915).

Inversodicraea macrothyrsa G. Tayl., sp. nov.

Saxicolella macrothyrsa A. Chev., Fl. Viv. Afr. Occ. Franç. i: 293, fig. 43A (1938), *nom. nud.* (descr. gall. tantum).

Inter species *Inversodicraeae* propter stamen unicum *I. ledermannii* proxima sed caulibus compressis efoliatis differt.

French Guinea. In branches of the River Dindia, Fouta-Djalon, *Caille* in *Herb. Chevalier 14740* (not seen).

I have been unable to examine the specimen described by Chevalier, but, from his

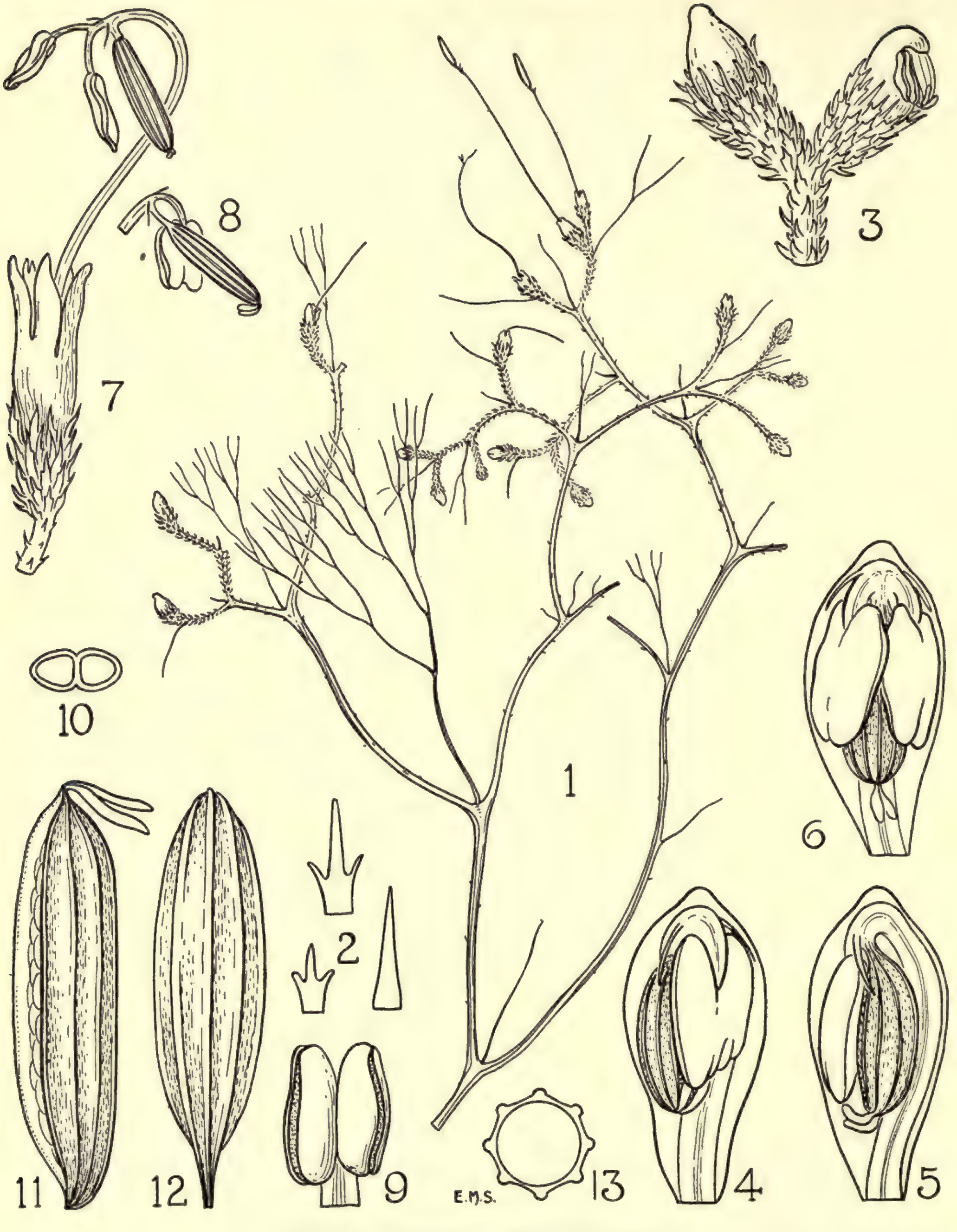

FIG. 8. *Inversodicraea abbayesii* G. Tayl.

1. Upper portion of plant (×1½). 2. Small leaves from apex of branch (×16). 3. Spathellae developing at apices of branches (×5). 4, 5, 6. Flowers within spathellae (×15). 7. Mature flower with 2 stamens (×6). 8. Flower with 1 stamen (×6). 9. Anther (×15). 10. Pollen-grain (×400). 11. Fruit (×20). 12. Capsule valve (×20). 13. Section of ovary (diagrammatic).

figures and French description, the plant cannot properly be referred to *Saxicolella*. Chevalier's illustrations clearly portray a unistaminate flower inverted within the spathella and this orientation at once excludes the species from *Saxicolella* which has an erect flower with one stamen. There are also other divergences. The plant from French Guinea is a branched caulescent herb up to 20 cm. with flattened branches and with spathellae in clusters at the ends of the leafless branches. *Saxicolella*, a local endemic in the South Cameroons, is a small plant bearing one-flowered rosulate shoots with filiform 1–3-fid leaves, about 5 mm. high, on a thallus.

Most species of *Inversodicraea* have two stamens, but in *I. pygmaea* and *I. abbayesii* unistaminate flowers occur and also in *I. ledermannii* (of which I have examined the type: *Ledermann 225* in the Berlin Herbarium) there is commonly only one, though Engler has figured the species with two. These considerations in conjunction with the other characters given by Chevalier have led me to refer his plant to *Inversodicraea*.

Inversodicraea adamesii G. Tayl., sp. nov. (Fig. 9).

Herba ramosa, 13 cm. attingens; rami dichotomi. *Folia* in caulis parte inferiori sparsa, cataphyllaria, minuta, integra vel lobata; folia superiora sub spathellis aggregata, lanceolata vel oblongo-lanceolata, integra vel lobata vel bidentata, usque ad 2 mm. longa, vel interdum bis bifida laciniis anguste ellipticis tumque usque ad 5 mm. longa. *Spathellae* 1–3 ad apicem ramulorum, anguste obovoideae, basi attenuatae, minute apiculatae, usque ad 6 mm. longae. *Flos* in spathella inversus; pedicellus in parte media flexuosus, ad apicem curvatus, c. 7 mm. longus, post anthesin erectus usque ad 2 cm. longus. *Tepala* 2, acicularia, c. 1 mm. longa. *Stamina* 2; filamenta per anthesin 2 mm. longa, andropodio 3 mm. longo; antherae 1·25 mm. longae. *Ovarium* ellipsoideum, c. 2 mm. longum, 6-costatum, costis commissuralibus inconspicuis exceptis; gynophorium 0·5 mm. longum; stigmata 2, subulata, persistentia. *Capsula* ellipsoidea, bivalvis, 3 mm. longa; valvae aequales, 3-costatae.

PORTUGUESE GUINEA. Chitale, Saltenho, 5 Feb. 1950, *Espirito Santo 2670* (Herb. Kew).

SIERRA LEONE. Kambia Bridge, 5 Dec. 1948, *Adames 177* (Herb. Kew, holotype).

This species, belonging to Engler's group *Tenaces*, is closely related to *I. garrettii* which is also a Sierra Leone plant, but *I. adamesii* differs in having only slightly compressed stems, capsules twice as big as those of *I. garrettii*, not compressed in the plane of dehiscence, and also in having the flowers usually solitary and not in dense clusters. The double commissural ribs on the capsule of *I. garrettii* are very prominent, so that each capsule valve has three median ribs and each margin is bordered by a half-commissural rib. In *I. adamesii* the double commissural ribs are inconspicuous and the valves are not ribbed at the margin. The new species bears a strong superficial resemblance to *I. kamerunensis* (Engl.) Engl., which is known only in the fruiting state, but this species from the Cameroons has membranous, hyaline oblong-ovate leaves aggregated towards the end of the flowering shoots.

The African *Podostemaceae*, so far as I have examined them, have cleistogamous

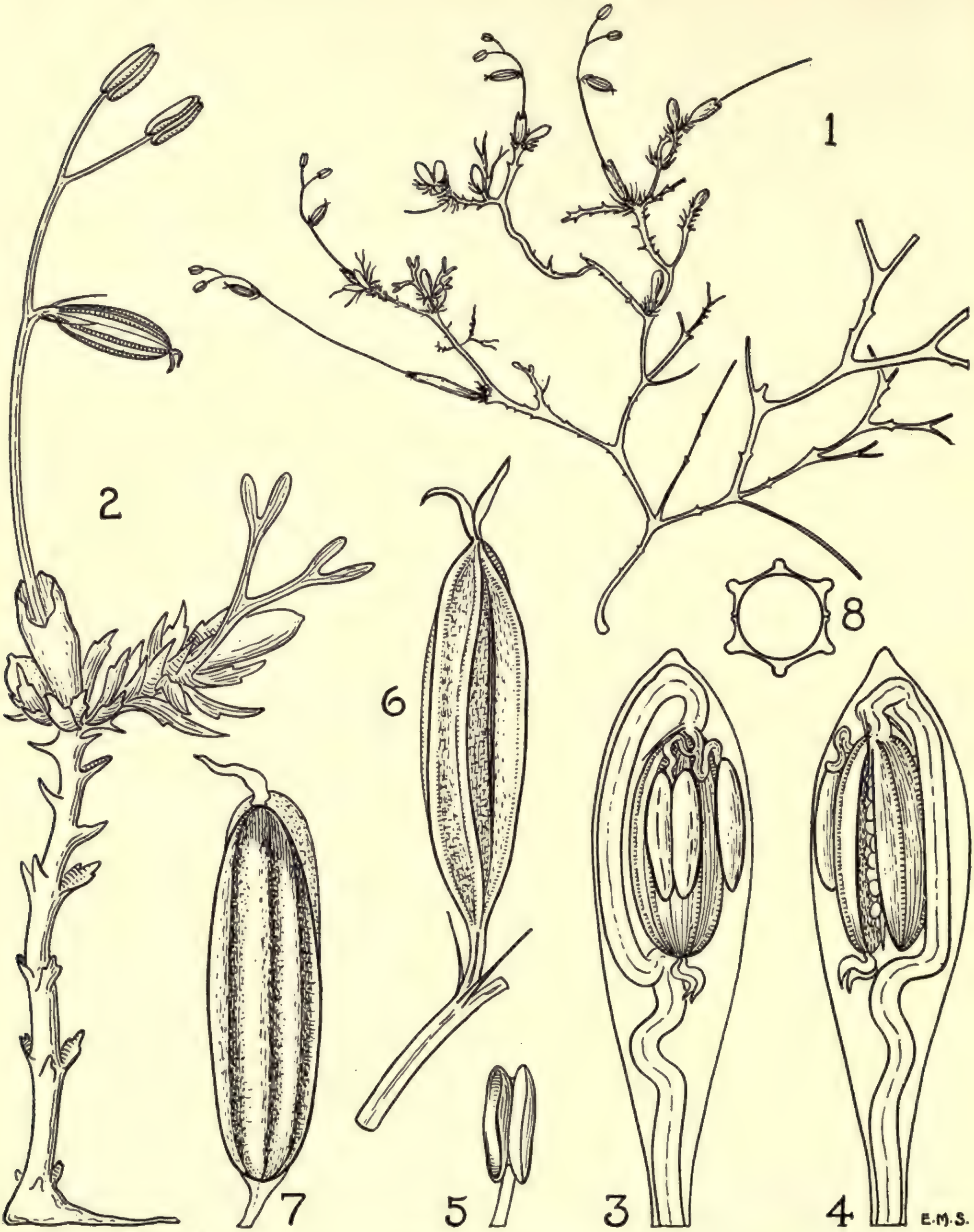

Fig. 9. *Inversodicraea adamesii* G. Tayl.

1. Plant showing habit (× 1½). 2. Flowering branch (× 6). 3, 4. Flowers within unruptured spathellae (× 12). 5. Anther (× 12). 6. Fruit (× 18). 7. Capsule valve (× 18). 8. Section of ovary (diagrammatic).

flowers, and in those species which produce their flowers within spathellae the fruits are ripe and full of seeds before emergence. Commonly the stamens embrace the styles and thus assist self-pollination. I have dissected several unruptured spathellae of *I. adamesii*, containing ripe seed-filled capsules, and though the anthers have already dehisced I have been unable to find any pollen. Possibly the species is apomictic.

The Santo specimen from Portuguese Guinea is in mature fruit with dehisced capsules only, but in habit and in capsule characters agrees very well with the type of *I. adamesii*.

Inversodicraea Ledermannii (Engl.) Engl. in Engl. & Drude, Veg. Erde ix, 3, 1: 274 (1915).—A. Chev., Fl. Viv. Afr. Occ. Franç. i: 297 (1938) pro parte. (Figs. A and B).

Dicraeia ledermannii Engl., Bot. Jahrb. xliii: 381, fig. 2, q–x (1909).

Ivory Coast. At the foot of Mt. Dô, in the high Cavally, near Gouékangouiné, 750 m., 2 May 1909, *Chevalier 21421* (Herb. Paris).

The material which I have seen is very immature and, as it does not include flowering or fruiting specimens, acceptance of Chevalier's identification is based entirely on vegetative characters. In leaf-shape, the Ivory Coast plant (Fig. A) is very similar to the type plant from South Cameroons (Fig. B). Both these plants

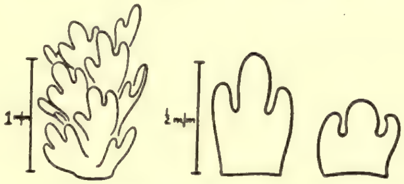

Fig. A. *Inversodicraea ledermannii* (Engl.) Engl.
Leaves from *Chevalier 21421*.

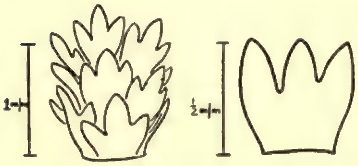

Fig. B. *Inversodicraea ledermannii* (Engl.) Engl.
Leaves from type-specimen (*Ledermann 225*).

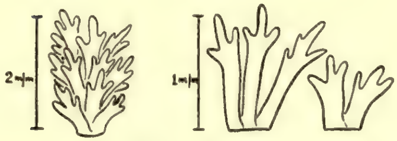

Fig. C. *Inversodicraea pygmaea* G. Tayl.
Leaves from *des Abbayes 353/1951*.

resemble *I. pygmaea* in the appearance of the densely leafy flowering shoots, but the leaves of *I. pygmaea* (Fig. C) while generally 3-dentate at the apex are linear-oblong in shape.

Inversodicraea pygmaea G. Tayl., sp. nov. (Figs. 10 and C).

Inversodicraea ledermannii sensu A. Chev., Fl. Viv. Afr. Occ. Franç. i: 297 (1938) pro parte; non Engl.

Herba pusilla, caulescens, 8–11 mm. alta (infructescentia inclusa); caules simplices, vel nonnunquam basi ramosa, ex thallo anguste fasciario emergentes. *Folia* lineari-oblonga, cornea, secus caules abbreviatos dense imbricata, apice plerumque 3-dentata dente medio longissimo, usque ad 1 mm. longa. *Spathellae* sessiles, ad caulium apices singulatim dispositae, obovoideae, usque ad 2 mm. longae. *Flos* in spathella inversus; pedicellus in parte superiori late curvatus, c. 2 mm. (post anthesin erectus et c. 5 mm.) longus. *Tepala* 2, acicularia, c. 0·5 mm. longa. *Stamen* 1; filamentum usque ad 1·5 mm. longum; anthera c. 0·5 mm. longa; pollen bicellulare. *Ovarium* ellipsoideum, c. 1·25 mm. longum, leviter 6-costatum costis commissuralibus inconspicuis exceptis; gynophorium c. 0·3 mm. longum; stigmata subulata, c. 0·3 mm. longa, saepe decidua. *Capsula* ellipsoidea, bivalvis, 1·5 mm. longa; valvae aequales, 3-costatae.

FRENCH GUINEA. Great Falls (circle of Kindia), on flat rocks at the edge of the river at low water, amongst 'Dicraeanthus parmelioides Chev.' [probably *Stonesia gracilis*], 4 Dec. 1951, *des Abbayes 353/1951* (Herb. Brit. Mus., holotype; Herb. Univ. Renn.); same locality, 19 Dec. 1908, *Chevalier 20232* (Herb. Paris).

This plant was identified by Chevalier as *I. ledermannii*, to which it is obviously closely related and which it very much resembles. Both species have unistaminate flowers but differ considerably in habit and foliage characters. *I. pygmaea* is a dwarf plant, commonly unbranched, and at most just exceeding 1 cm. in height. *I. ledermannii* is much bigger (up to 4 cm.) and more branched. The leaves of *I. pygmaea* are narrow (linear-oblong) with a claw and narrowly 3-toothed at the apex, whereas those of *I. ledermannii* are short, broadly oblong with three broad apical teeth. Furthermore, in *I. pygmaea* the leaves are closely imbricated to the base of the stem, but in *I. ledermannii* they are more distant and scattered.

Inversodicraea tenuifolia G. Tayl., sp. nov. (Fig. 11).

Herba pusilla, acaulis, thallo radicali saxis adhaerens; gemmae sessiles, (1–)2–3-florae, in thallo irregulariter dispositae. *Folia* rosulata, sessilia, lineari-subulata, exstipulata, basi abrupte dilatata concava, usque ad 4·5 mm. longa. *Spathellae* subobovoideae, c. 2·75 mm. longae. *Flos* in spathella inversus, per anthesin c. 8 mm. altus; pedicellus leviter curvatus, c. 2·5 mm. longus, demum erectus et usque ad 8 mm. longus. *Tepala* 2, minutissima. *Stamina* 2; filamenta demum usque ad 3 mm. longa, andropodio brevi vel brevissimo; antherae 1 mm. longae et 0·75 mm. latae; pollen unicellulare. *Ovarium* ellipsoideum, c. 1·75 mm. longum et 0·8 mm. latum, tenuiter 8-costatum; gynophorium 0·5–0·75 mm. longum; stigmata 2, brevissima,

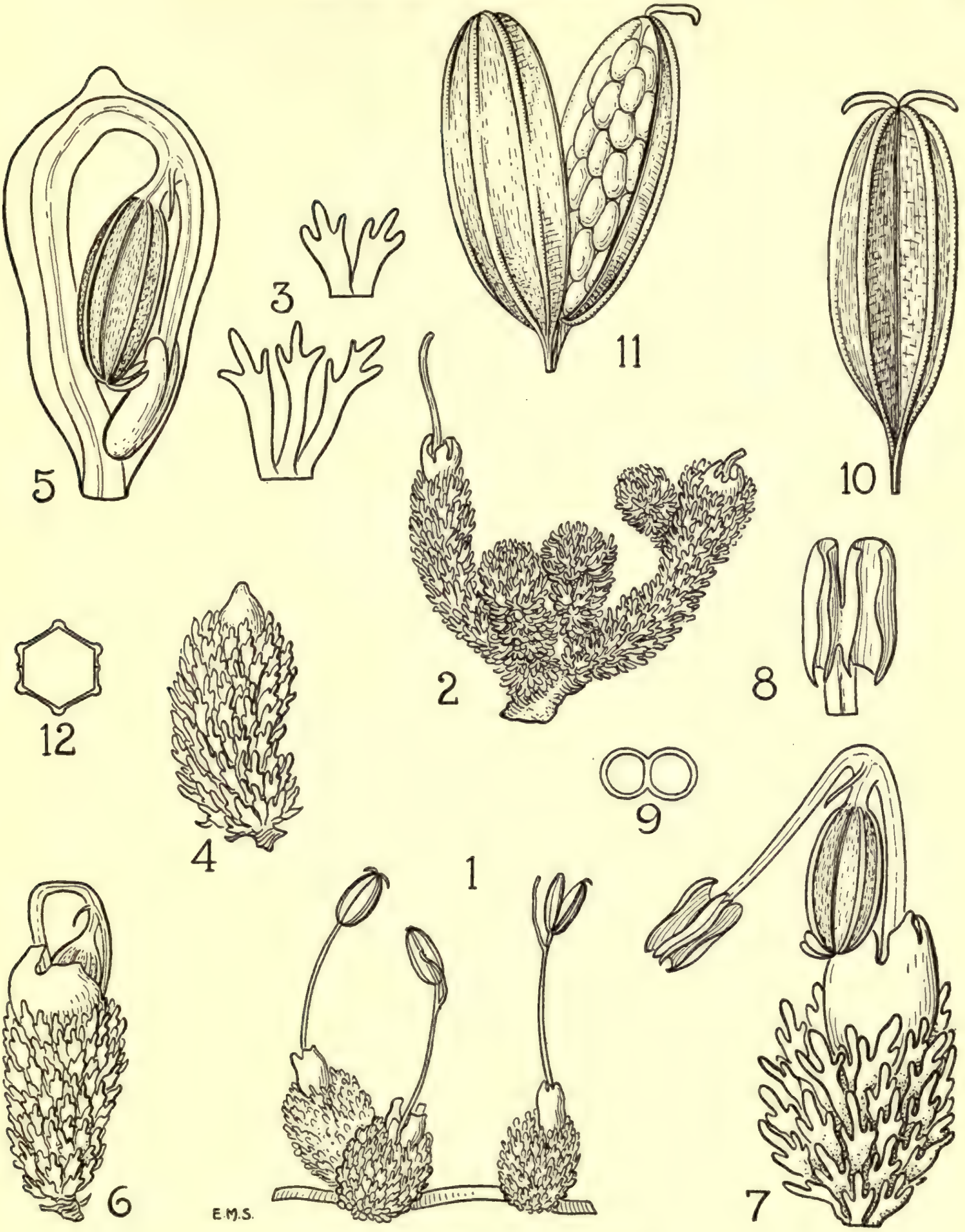

FIG. 10. *Inversodicraea pygmaea* G. Tayl.

1. Flowering shoots on narrow thallus (×6). 2. Branching flowering shoot (×6). 3. Leaves (×20). 4. Shoot with young spathella (×10). 5. Flower within unruptured spathella (×30). 6. Flower emerging from spathella (×10). 7. Young flower (×20). 8. Anther (×30). 9. Pollen-grain (×400). 10. Fruit (×30). 11. Dehisced fruit (×30). 12. Section of ovary (diagrammatic).

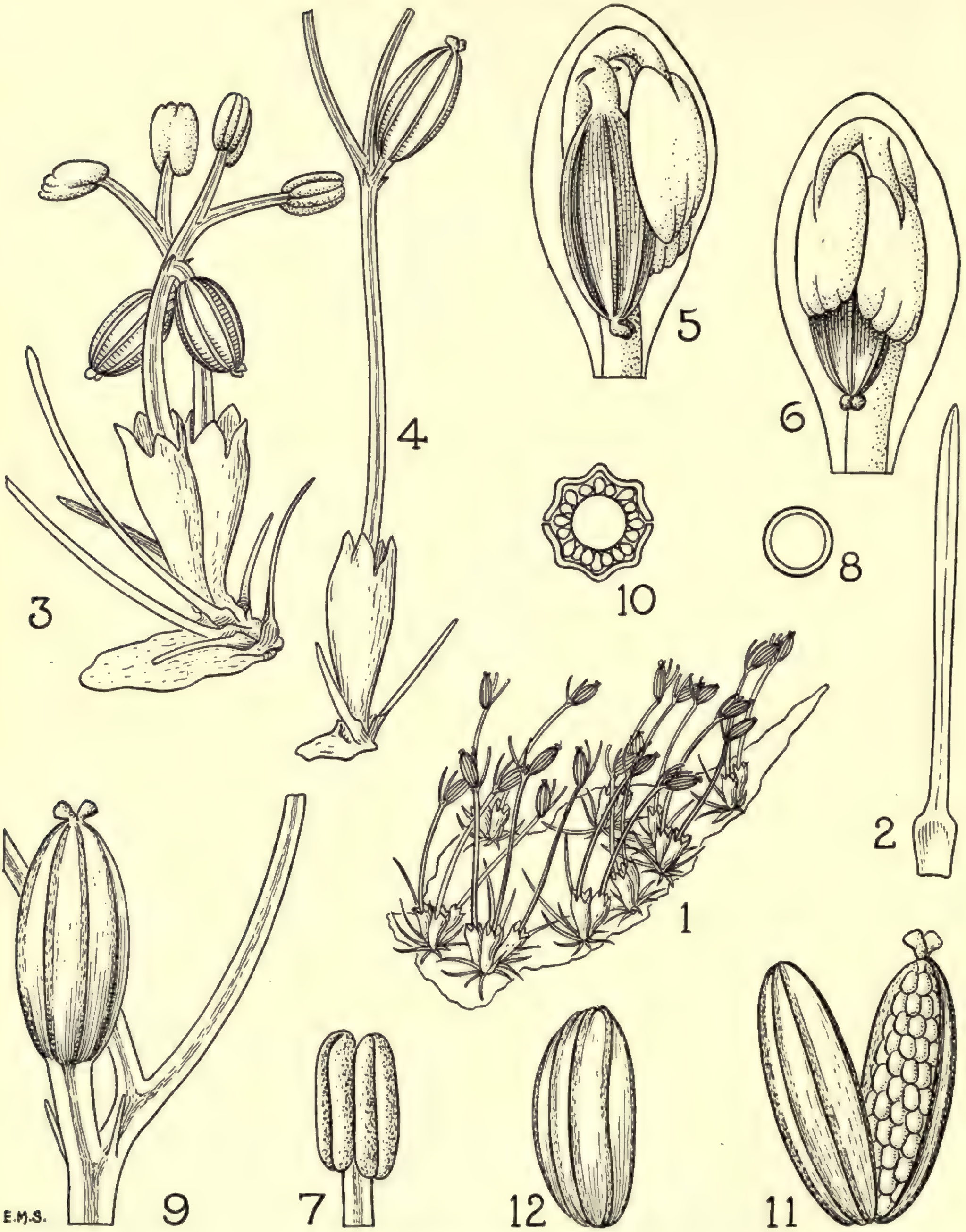

FIG. 11. *Inversodicraea tenuifolia* G. Tayl.

1. Plant showing habit (× 3). 2. Leaf (× 15). 3. Flowering shoot (× 10). 4. Shoot with young fruit (× 10). 5, 6. Flowers within unruptured spathellae (× 20). 7. Anther (× 20). 8. Pollen-grain (× 100). 9. Young capsule with persistent tepals and androecium (× 20). 10. Section of ovary (diagrammatic). 11. Dehisced capsule (× 20). 12. Capsule valve (× 20).

crassa, patentia, persistentia. *Capsula* ellipsoidea, bivalvis, 2 mm. longa; valvae aequales, praeter costas marginales 3-costatae.

NIGERIA. Ogoja Province: on the Boje–Aboabam path crossing the Afi River, aquatic herb on rocks, 13 Dec. 1950, *Keay FHI. 28241* (Herb. Kew, holotype; Herb. Brit. Mus.).

This species is distinguished by its 2–3- (rarely 1-) flowered shoots borne on a thallus, and by having rosulate linear-lanceolate leaves.

Inversodicraea musciformis G. Tayl., sp. nov. (Fig. 12).

Herba caulescens, 2 cm. attingens; caules ramosi. *Folia* in caulis parte inferiori cataphyllaria, minuta, acicularia vel linearia; folia superiora sub spathellis aggregata, disticha, lineari-subulata, basi gradatim dilatata et concava, subamplexicaulia, exstipulata, usque ad 14 mm. longa. *Spathellae* caulis apicem versus dispositae, ramulos terminantes, ovoideae, apice umbonatae, c. 2·75 mm. longae. *Flos* in spathella inversus; pedicellus curvatus, c. 2 mm. longus, post anthesin erectus usque ad c. 8 mm. longus. *Tepala* 2, acicularia, 0·6 mm. longa. *Stamina* 2; filamenta c. 0·8 mm. longa, andropodio c. 0·5 mm. longo; antherae 0·75 mm. longae et 0·7 mm. latae, accumbentes; pollen unicellulare. *Ovarium* ellipsoideum vel obovoideum, 1·75 mm. longum tenuiter 8-costatum; gynophorium brevissimum; stigmata 2, botuliformia, 1 mm. longa, in spathella antheras versus deflexa, persistentia. *Capsula* ellipsoidea, bivalvis, 1·75 mm. longa; valvae aequales, praeter costas marginales 3-costatae, altera persistens, altera decidua.

BRITISH CAMEROONS. Bamenda Province: north-west slopes of Mba Kokeka Mt., 2,300 m., moss-like herb anchored to wet rock, 3 Jan. 1951, *Keay FHI. 28542* (Herb. Kew, holotype; Herb. Brit. Mus.).

The distichous linear-subulate leaves aggregated at the apex of abbreviated 1-flowered branchlets, the conspicuous clavate stigmas and the branching habit are sufficient to distinguish this species.

Inversodicraea variabilis G. Tayl., sp. nov. (Fig. 13).

Herba pusilla, caulescens, usque ad 8·5 mm. alta; caules simplices ex thallo radicali emergentes. *Folia* sessilia, disticha, stipulata vel simulate exstipulata, basi vaginata, cornea, in caulis parte inferiori cataphyllaria; folia superiora bifida vel bis bifida, laciniis anguste linearibus, usque ad 7·5 mm. longa. *Spathellae* 1–2(–7) ad caulium apices, ellipsoideae vel subovoideae, basi attenuatae stipitatae, apice breviter umbonatae, usque ad 3·25 mm. longae. *Flos* in spathella inversus; pedicellus in parte superiori curvatus, c. 3·25 mm. (post anthesin 4 mm.) longus. *Tepala* 2, acicularia, c. 0·5 mm. longa. *Stamina* plerumque 2 sed interdum 3 vel raro 4; filamenta per anthesin c. 1 mm. ad c. 3·5 mm. longa, andropodio subnullo vel crasso usque ad 1 mm. longo; antherae 1 mm. longae et 1 mm. latae, accumbentes; pollen bicellulare. *Ovarium* ellipsoideum, c. 1·5 mm. longum, leviter 8-costatum; gynophorium brevissimum; stigmata forma variantia, brevissima, clavata vel flabellata et complanata tumque apice 2–3-lobata, persistentia. *Capsula* ellipsoidea, bivalvis, 1·5 mm. longa; valvae aequales, praeter costas marginales 3-costatae.

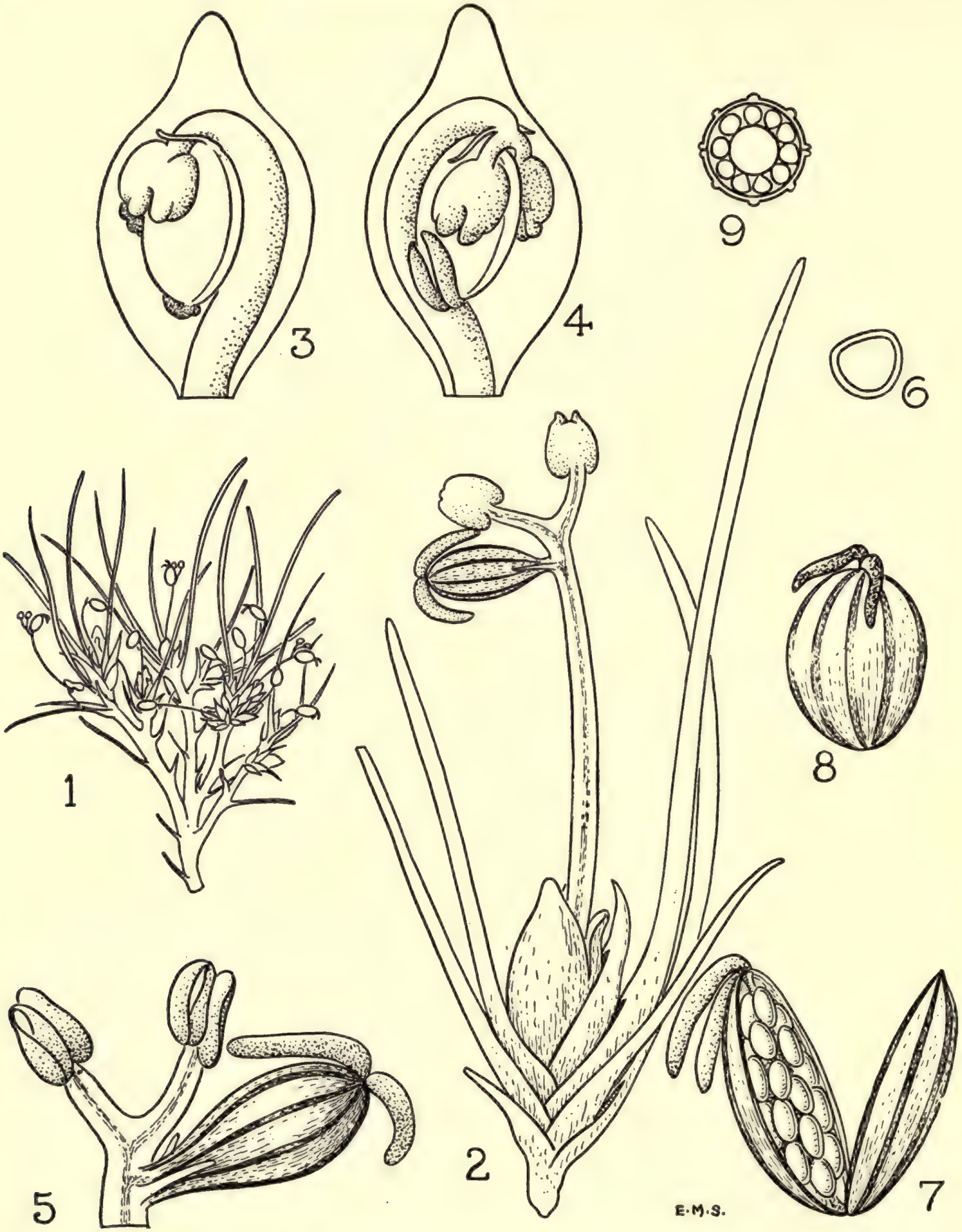

FIG. 12. *Inversodicraea musciformis* G. Tayl.

1. Flowering plant (× 2). 2. Flowering shoot (× 10). 3, 4. Flowers within unruptured spathellae (× 20). 5. Mature flower (× 20). 6. Pollen-grain (× 150). 7. Dehisced capsule (× 20). 8. Capsule valve with persistent stigmas (× 20).

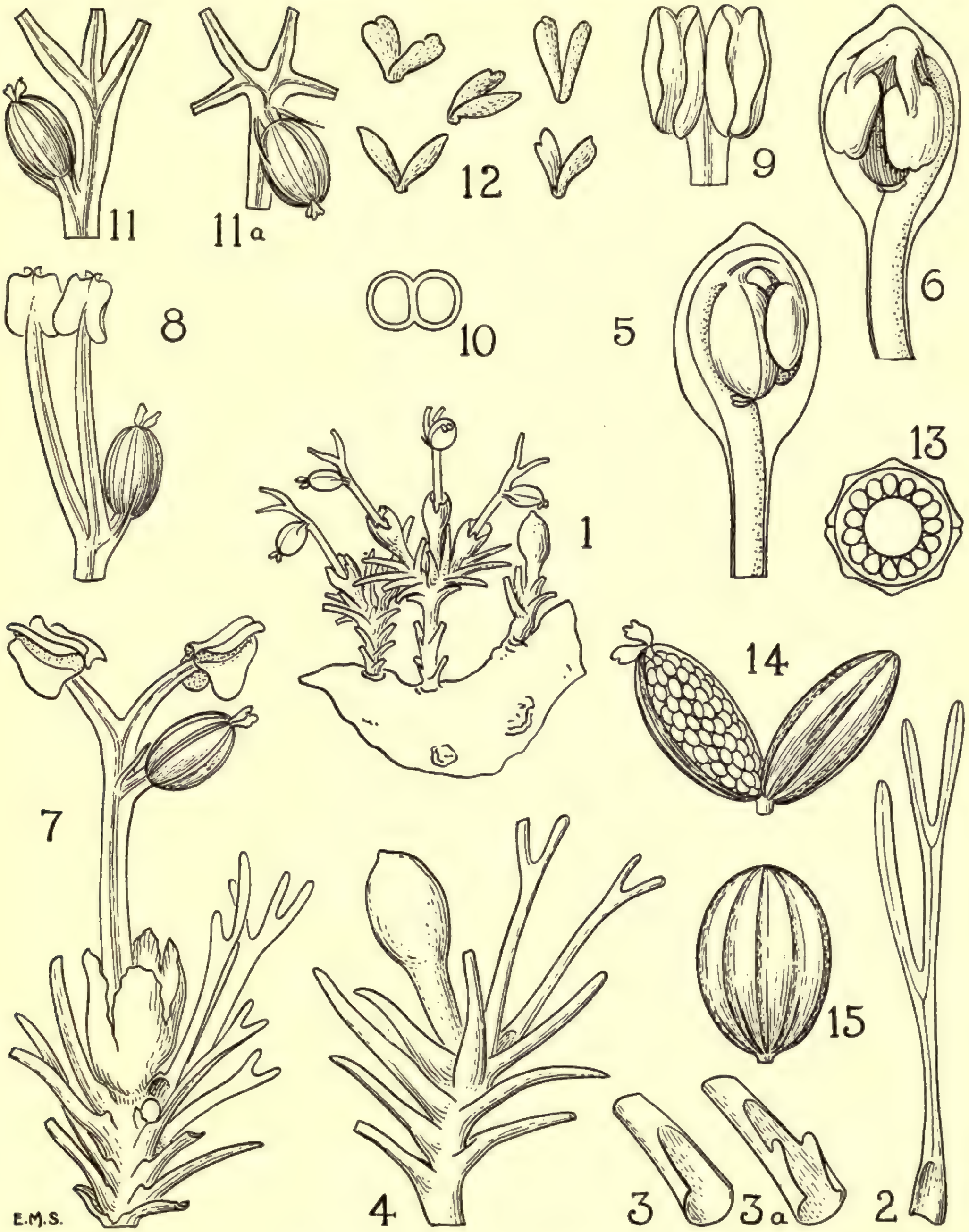

FIG. 13. *Inversodicraea variabilis* G. Tayl.

1. Plant showing habit (×4). 2. Leaf (×10). 3, 3*a*. Leaf bases (×20). 4. Shoot with young spathella (×10). 5, 6. Flowers within unruptured spathellae (×15). 7. Shoot with mature flower (×10). 8. Flower (×10). 9. Anther (×20). 10. Pollen-grain (×360). 11, 11*a*. Flowers showing variation in androecium (×10). 12. Variation of stigmas (×40). 13. Section of ovary (diagrammatic). 14. Dehisced capsule (×20). 15. Capsule valve (×20).

British Cameroons. Mamfe District: by Ikom–Mamfe road ferry, River Mun Aiya, on flat rock at water's edge, firmly fixed to rock at water-level in falling river, 20 Jan. 1951, *Keay FHI. 28688* (Herb. Kew, holotype; Herb. Brit. Mus.).

The unbranched flowering shoots with distichous leaves (the upper lobed) bearing stipitate spathellae at the apex are sufficient to differentiate this new species. I have placed this plant in *Inversodicraea* mainly because the flower is inverted within the spathella and the stamens are most commonly two. As the specific epithet implies, *I. variabilis* is extremely plastic and the variability of several characters which it displays would normally transcend generic limits. The leaves may be distinctly stipulate or stipules may be absent and the wide variation in the androecium and in the shape of the stigmas is particularly noteworthy.

Inversodicraea keayi G. Tayl., sp. nov. (Fig. 14).

Herba caulescens, 6 cm. attingens; caules ex thallo radicali emergentes, inferne nudi, superne ramosi; ramuli interdum laxe dispositi sed plerumque ad caulis apicem congesti. *Folia* sessilia, disticha, aliquantulum navicularia, exstipulata, in ramos abbreviatos floriferos aggregata, usque ad 2 mm. longa. *Spathellae* solitariae, ramulos terminantes, ovoideae vel globosae vel late ellipsoideae, apiculatae vel umbonatae, c. 2·5 mm. longae. *Flos* in spathella breviter pedicellatus, inversus; pedicellus curvatus, c. 2 mm. longus, demum erectus et 3 mm. longus. *Tepala* 2, minutissima. *Stamina* 2; filamenta c. 0·5 mm. longa andropodio aequilonga; antherae 0·75 mm. longae et c. 0·5 mm. latae, accumbentes; pollen unicellulare. *Ovarium* late ellipsoideum, 1·5 mm. longum et 1 mm. latum, tenuiter 8-nervium; gynophorium c. 0·5 mm. longum; stigmata 2, botuliformia, c. 0·5 mm. longa, antheras versus deflexa. *Capsula* ellipsoidea, bivalvis, 1·5 mm. longa; valvae aequales, praeter costas marginales leviter 3-costatae, altera persistens, altera decidua.

British Cameroons. Bamenda Province: Banso, 1,650 m., on rocks at water-level in small stream, 5 Jan. 1951, *Keay FHI. 28457* (Herb. Kew, holotype; Herb. Brit. Mus.); near Sagbo, Ndop, 1,800 m., on steep granite cliff-face under dripping water, 20 Dec. 1952, *Adams 11073* (Herb. Brit. Mus.).

This is one of a group of species of *Inversodicraea* in which the leaves on the flowering shoots are closely imbricated and arranged distichously. *I. keayi* is characterized by having the dwarf flowering branches aggregated in heads or clusters.

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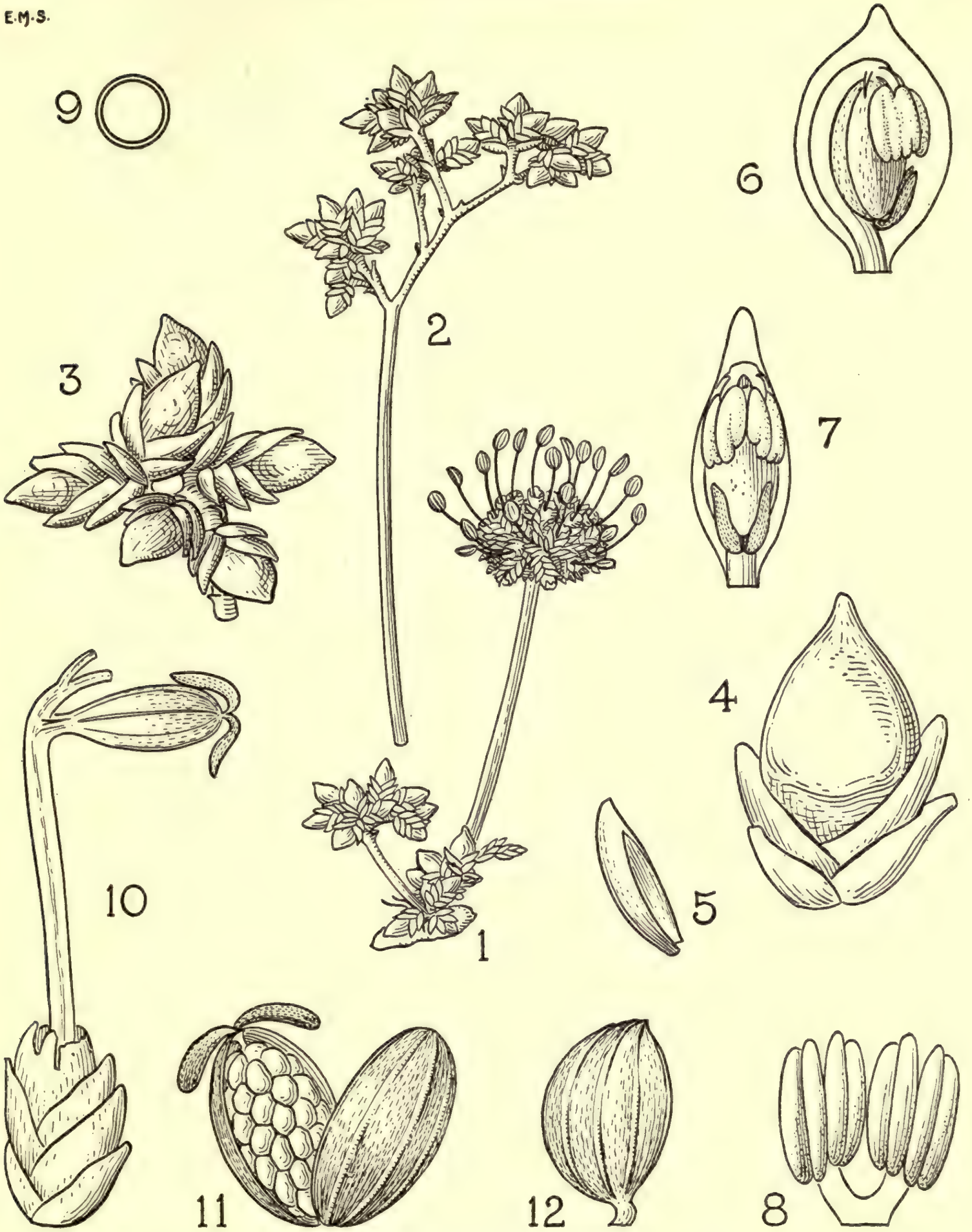

FIG. 14. *Inversodicraea keayi* G. Tayl.

1. Plant showing habit (×2). 2. Plant with young spathellae terminating short branches (×2). 3. Cluster of flowering branches (×6). 4. Single flowering shoot (×16). 5. Leaf (×16). 6, 7. Flowers within unruptured spathellae (×16). 8. Stamens (×24). 9. Pollen-grain (×180). 10. Flowering shoot at maturity (×16). 11. Dehisced capsule (×24). 12. Persistent capsule valve (×24).

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I

V. H. HEYWOOD

BULLETIN OF
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LONDON : 1954

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I

BY

V. H. HEYWOOD
(Botany School, Cambridge)

Pp. 81–122

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NOTULAE CRITICAE AD FLORAM HISPANIAE PERTINENTES, I

By V. H. HEYWOOD

SYNOPSIS

This is the first of a series of papers on the taxonomy of the Spanish flora. It is primarily concerned with the Montes del Estado de la Sierra de Cazorla, province of Jaén, of which the author is writing a flora; but it also contains notes on species outside that area and other matters of interest concerning Spanish floristics that have come to his notice during this work. As it may be some time before it will be possible to publish the complete flora of the Montes de Cazorla, all new records for that area in the families dealt with in this paper are given.

The Montes de Cazorla will provide material for a most illuminating phytogeographical and phytosociological study, but before this is possible complete assessment and revision of the flora are necessary. For as Braun-Blanquet (1945) has recently pointed out, 'l'étude phytosociologique exige une connaissance parfaite des entités systématiques'.

A brief summary of the territory and climate of the Montes de Cazorla is given in Heywood (1950); further details will be found in Mackay (1917) and Lacaita (1929). Some introductory notes on the botanical history of the region will be of assistance in understanding the type of problems encountered there.

The Montes de Cazorla remained completely unknown to botanists until Gandoger (1904, 1905) made two short excursions there in 1902 and 1903. More extensive collections were made in the Montes de Cazorla by the French collector Reverchon during his collecting journeys in the provinces of Jaén and Granada between 1900 and 1906, but the exact date of his first visit to the Cazorla area is not clear. The results of Reverchon's journeys, containing a large number of new species and varieties, were published by the Abbé Hervier (1905, 1906, 1907) in collaboration with several other botanists, including Debaux and Degen. These accounts were very severely criticized by the Spanish botanist Pau (1904, 1905, 1906, 1907) with, as Lacaita was later to say, 'un certain défaut de juste modération'. But they constitute none the less the only basis for our knowledge of this important and fascinating flora.

Lacaita (1929) made two brief expeditions in the Montes de Cazorla—in 1927 with A. J. Wilmott, and in 1928 with J. Cuatrecasas. He subsequently wrote a paper which rectified some of the many orthographic and topographic errors in Hervier's accounts and gave a brief list of additions to the flora.

The last work of importance to be published with a bearing on the Montes de Cazorla was Cuatrecasas's (1929) monographic study on the flora and vegetation of the neighbouring Macizo de Mágina. Cuatrecasas of necessity revised to some extent the collections from the Montes de Cazorla.

Further small collections were made by Dr. P. L. Giuseppi in 1936, Giuseppi and Heywood in 1947, and by M. M. Bolaños and L. Ceballos, of the Instituto Forestal, Madrid, during their visits to the forests of Cazorla. The latest large-scale investigation was that of the present writer and P. H. Davis in 1948, during an expedition to Spain under the aegis of the Royal Horticultural Society of London.[1]

I wish to thank the Keeper of Botany at the British Museum and the Keeper of the Herbarium at Kew for permission to work in their Departments and for the assistance of their staffs. I am particularly grateful to Mr. E. J. H. Corner for reading the manuscript and for discussing many of the problems with me. Several other botanists have at one time or another given me assistance; amongst these I should like to mention Dr. Charles Baehni, Director of the Conservatoire et Jardin Botaniques, Geneva, who has sent me Boissier types on loan, and helped me with bibliographical details. I am indebted also to Mr. J. E. Dandy, who has taken much trouble in preparing the manuscript for the press.

This work has been undertaken mainly in the Botany School, Cambridge, and I am grateful to the Curator of the Herbarium, Dr. S. M. Walters, for facilities.

The first set of *Heywood & Davis* 1948 specimens, including holotypes, is deposited in the Herbarium of the British Museum (Natural History); isotypes are in the Kew, Edinburgh and Cambridge Herbaria.

The following abbreviations of Herbaria are used in the text:

BM = Herbarium, British Museum (Natural History).
C = Herbarium, Botany School, University of Cambridge.
E = Herbarium, Royal Botanic Garden, Edinburgh.
K = Herbarium, Royal Botanic Gardens, Kew.

RANUNCULACEAE

Aquilegia cazorlensis Heywood, sp. nov.

Species inter congeneres Baeticas valde distincta; affinis *A. pyrenaicae* DC., sed habitu magis ramoso, foliis caulinis petiolatis numerosis (nec solum 1 vel 0), foliis superne pubescentibus vel glabrescentibus (nec glabris), floribus duplo minoribus, distinguitur; ab *A. discolori* Levier & Leresche foliis caulinis petiolatis, caulibus 1–3-floris, floribus concoloribus, sepalis latioribus, calcaribus crassioribus, inter alia differt; ab *A. nevadensi* Boiss. & Reut. statura minori (15–25 cm.), caulibus plerumque inferne nec superne ramosis, foliis haud in utraque pagina dense viscoso-pubescentibus, calcaribus lamina petalorum non longioribus, longe divergit; ab *A. vulgari* L. statura minori, foliis minoribus, floribus minoribus numerosioribus calcaribus leviter recurvatis nec uncinatis, imprimis removitur.

Herba subalpina, humilis, gracilis. *Caules* 15–25 cm. alti, inferne ramosi aut subglabri aut pubescentes aut glanduloso-pubescentes, sulcato-striati, flexuosi, 1–3-flori. *Folia* basalia biternata, longe petiolata, petiolo 4–10 cm. longo subglabro vel longe pubescenti vel glanduloso-pubescenti, petiolulis 0·75–2(–3) cm. longis indumento eodem; foliorum segmenta secundaria obovato-cuneata, 0·75–2 cm. longa, profunde tripartita vel trifida, lobis 2–5 crenatis crenis obtusis vel 2–5 dentatis obtusiusculis; folia caulina petiolata, basilaribus similia sed multum majora; segmenta foliorum omnium supra glabrescentia vel parce aut distincte pubescentia, infra glauca; folia superiora parva, sessilia, bracteiformia, 3-fida vel 3-lobata vel lanceolata integra.

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[1] Since this paper was written the author has made further extensive studies in the area, during the years 1951 and 1952.

Inflorescentiae 1–3(–5)-florae; pedicelli usque ad 10 cm. longi; flores mediocres, nutantes, caerulei, extus parce pubescentes. *Sepala* caerulea apice viridi, ovata vel elliptico-ovata, plerumque acuminata, 10–16 mm. longa, 5–7 mm. lata. *Petalorum* lamina obovata, apice rotundata, 8–9 mm. longa, 6–7 mm. lata; calcar 6–7 (–9) mm. longum, apice 0·75–1·25 mm. latum, leviter recurvatum, lamina brevius vel eam subaequans. *Stamina* lamina longiora; antherae flavae; staminodia lanceolata, acuta. *Styli* stamina subaequantes. *Follicula* adhuc ignota. Floret Jun.–Jul.

Prov. *Jaén*: Montes de Cazorla, Sierra de Pozo Alcón, Pico de Cabañas, shady limestone slopes by the arch, flowers resembling *A. vulgaris* but dwarf form?, 2,000 m., 1 July 1948, *Heywood & Davis 432* (BM, holotype; C; E; K).

In the key given by Munz in his revision of *Aquilegia* (in L. H. Bailey, Gent. Herb. vii: 17 (1946)) this new species comes out at a choice between a group with 'sepals 7–8 mm. wide, 15–20 mm. long, blue-violet; spurs 7–11 mm. long' (*A. einseleana*, *A. thalictrifolia*) and a group with 'sepals 10–18 mm. wide, 18–35 mm. long; spurs 10–18 mm. long' (*A. pyrenaica*, *A. bertolonii*, *A. bernardii*, *A. fragrans*). In our species the spurs barely reach 9 mm. long in exceptionally large-flowered specimens. None the less, *A. pyrenaica* appears to be the closest affinity for the new species.

The Spanish species of *Aquilegia* are:

A. paui Font Quer, with ternate basal leaves[1] (Catalonia).

A. montsicciana Font Quer, with ternate basal leaves, one cauline leaf and spurs longer than the petal-lamina (Catalonia).

A. vulgaris L. and var. *hispanica* Willk.; *vide differentias.*

A. discolor Levier & Leresche (Picos de Europa); *vide differentias.*

A. aragonensis Willk., with no cauline leaves and spurs longer than the petal-lamina (Prepirineos de Aragón).

A. pyrenaica DC. (Pyrenees); *vide differentias.*

A. nevadensis Boiss. & Reut. (Sierra Nevada); *vide differentias.*

A. cazorlensis Heywood (Montes de Cazorla).

Despite its very obvious differences from *A. cazorlensis*, *A. pyrenaica* rather than *A. nevadensis*, the geographical neighbour, is the nearest relation of the new species.

Payson (in Contrib. U.S. Nation. Herb. xx: 134 (1918)), in a discussion of the taxonomic characters in *Aquilegia*, writes: 'Plants differing by comparatively slight characters yet consistently separated in range must be considered distinct species, while plants exhibiting what seem to be no greater differences, yet having no distinct ranges, must be considered conspecific. Since hybridism is so easy and so prevalent, it is difficult to see how very closely related species could remain distinct when growing together.'

Judged by these criteria *A. cazorlensis* must be considered a 'good species'—it is clearly distinguished from all other Spanish species but one morphologically and in range. *A. vulgaris* var. *hispanica* which grows in the same area is only distantly related to it.

Ecological and altitudinal isolation are important in *Aquilegia*. Even if *A. vulgaris* var. *hispanica* were sufficiently related to *A. cazorlensis* as to hybridize with it (and, considering the facility of hybridization in the genus, it possibly could), the two species occupy distinct altitudinal and ecological areas. *A. vulgaris* var. *hispanica* inhabits damp shady places in valleys in the Montes de Cazorla, whilst *A. cazorlensis* grows on the dry limestone summit screes of the Cerro Cabañas at about 2,000 m. altitude.

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[1] Munz (1946) described *A. paui* as having ternate basal leaves. In the specimens of *A. paui* distributed in *Flora Iberica Selecta* the basal leaves are biternate!

Skalińska's accounts of certain *Aquilegia* species have been used in differentiating *A. cazorlensis* from *A. pyrenaica*, etc. (see Skalińska in Proc. Linn. Soc. Lond. clii: 328–347 (1940); op. cit. cliv: 259–263 (1943)).

HELLEBORUS FOETIDUS L., Sp. Pl. i: 558 (1753).—Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 962 (1880).

Prov. *Jaén*: Montes de Cazorla, Barranco de la Garganta near Casa Forestal of La Nava de San Pedro, in *Pinetum*, fruit, 25 June 1948, *Heywood & Davis 124* (BM).

This species is widespread in the Montes de Cazorla.

CLEMATIS VITALBA L., Sp. Pl. i: 544 (1753).—Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 953 (1880).

Prov. *Jaén*: Montes de Cazorla, Barranco del Guadalentín, in *Pinetum* in open parts, 30 June 1948, *Heywood & Davis 407* (BM)—typical specimens, not in fruit.

HEPATICA NOBILIS Mill., Gard. Dict., ed. 8 (1768).

Var. HISPANICA (Willk.) G. Beck in Wien. Ill. Gart.-Zeit. xxi: 345 (1896).

Anemone hepatica var. *hispanica* Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 947 (1880).—Ulbr. in Engl., Bot. Jahrb. xxxvii: 270 (1906).
Anemone hepatica auct. hisp.

Prov. *Jaén*: Montes de Cazorla, limestone rocks opposite the pinnacles of Los Organos, 27 June 1948, *Heywood & Davis 257* (BM); Sierra de Cazorla, in rup. umbrosis al Poyo Cerezo, 15 June 1928, *Lacaita 452* (BM).

These specimens, although they do not possess mature fruits, agree with Willkomm's description of *Anemone hepatica* var. *hispanica*. They are, I believe, new records for the flora of Jaén.

RANUNCULUS GRANATENSIS Boiss., Diagn. Pl. Or. Nov. iii, 1: 8 (1853).

Ranunculus acris auct. hisp. maj. part. teste Freyn; non L.

Prov. *Jaén*: Montes de Cazorla, Barranco del Guadalentín, creeping, rootstock horizontal, perennial, 26 June 1948, *Heywood & Davis 237* (BM); Sierra de Cazorla, banks of the Aguas Negras, 15 June 1928, *Lacaita 458* (BM).

This is almost certainly *Ranunculus granatensis* Boiss. Freyn (in Willk. & Lange, Prodr. Fl. Hisp. iii: 938 (1880)) equates this species with *R. steveni* Andrz. ex Bess., but he gives no justification for his action. Until *R. acris* L. (*sensu lato*) is revised it is advisable to retain Boissier's name for the southern Spanish plant.

No. *237* possesses the following characters: elongated more or less horizontal rootstock, covered (as is the base of the stem) with long red hairs; leaves densely clothed with long appressed subsericeous hairs on the lower surface, the upper surface with a regular covering of long spiked hairs; leaves large, more or less reniform, deeply tripartite, the lateral segments being 2-sect, the central 3-sect into more or less oval lobes.

RANUNCULUS FLABELLATUS Desf., Fl. Atlant. i: 438, t. 114 (1798).—Freyn in Willk. & Lange, Prodr. Fl. Hisp. iii: 923 (1880).

Var. aff. var. *molli* Freyn et var. *nevadensi* Freyn.

Prov. *Jaén*: Le Pozo, lieux arides et calcaires, 1,500 m., May 1905, *Reverchon 1399* (BM)—as *R. flabellatus* var. *ovatus* Freyn.

Freyn's division of this highly polymorphic species into fourteen taxa is difficult to put into practice. I am unable to see the validity of many of his variants: there are numerous transitions in leaf-shape—one of the main characters he employs for taxonomic separation. Many of the forms rest upon their geographical distribution (or have done in the past) and in herbaria they seem to have been identified on that basis.

This gathering of Reverchon's, which was named var. *ovatus* by Hervier, has rather narrower leaf-lobes than var. *ovatus* and in this respect comes nearer to var. *nevadensis* and var. *mollis*. It is very similar to var. *nevadensis* from Granada (near Dientes de la Vieja) collected by Wilmott and to var. *mollis* from the Sierra de Alcaraz collected by Lacaita, while not far removed from material determined as var. *ovatus* from Navarre and Castille.

Indeed the material of *R. flabellatus* which I have seen from the south of Spain shows that a revision of the taxa that occur there is necessary: the discontinuity between the varieties and forms described by Freyn has been broken down by later collections.

RANUNCULUS MALESSANUS Degen & Hervier apud Hervier in Bull. Acad. Internat. Géogr. Bot. xvi: 222 (1906).

Ranunculus nigrescens sensu Hervier, op. cit. xv: 26 (1905); non Freyn.

Prov. *Jaén*: Sierra de la Cabrilla, *Reverchon 1317* (*fide* Degen & Hervier, syntype); Sierra de Cazorla, rocks near headwaters of Guadalquivir, 31 May 1928, *Lacaita 327* (BM)—with note 'Pau reduces *R. malessanus* to *R. nevadensis* but ? ? ?'

This species was first distributed by Hervier as *Ranunculus nigrescens* Freyn, but in 1906 he and Degen decided after comparison with the type of that species that the plants from the Sierras de Castril, de la Malessa and de la Cabrilla should be referred to a new species, *R. malessanus*. The differences (from *R. nigrescens*) given were: glabrous not pilose axis (receptacle), slightly setulose achenes (not completely glabrous), leaves not only bicrenate but deeply incised-trilobed with the lobes deeply tricrenate and the lobuli in turn crenulate.

Pau (Carta 1: 3) dismisses *R. blepharicarpos*, distributed under the same number (*1317*), thus: 'No lo es. No se puede separar del *R. nevadensis* Willk. Receptáculo alampiñado; mayor.' Later (Carta 4: 1) he disposes of *R. malessanus* as *R. nevadensis* saying that it is the *R. blepharicarpos* which with the same number appeared in his first *Carta*. In other words, both Hervier's *R. blepharicarpos* and *R. malessanus* are equated by Pau with *R. nevadensis*. Pau blames Degen and Hervier's equivocation perhaps on the paucity of material of *R. nevadensis* in herbaria.

I cannot agree with Pau. Because of its glabrous receptacle *R. malessanus* belongs to a different group from *R. nevadensis* and, as Degen and Hervier say, should be placed near *R. flabellatus*. The root character—stalk of root subnaked or with intricate fibres—I cannot follow and it does not seem to be very important taxonomically. I should place *R. malessanus* in the former category whereas Degen and Hervier place it in the latter.

R. malessanus differs from *R. nevadensis* in several good characters: in the stem's being one-flowered or rarely two-flowered (not 2–4-flowered); in leaf-shape, which gives it a characteristic facies—three-lobed (less deeply divided than the tripartite or ternate leaves of *R. nevadensis*), these three divisions crenately three-lobed and the small lobes in turn very obtusely crenate; also the leaves have raised nerves not impressed; and the sepals are not lutescent-margined.

R. malessanus is one of a complex of interrelated species embracing *R. suborbiculatus* Freyn, *R. nevadensis*, *R. escurialensis* Boiss. & Reut. ex Freyn and *R. carpetanus* Boiss. & Reut. Further study of this group is needed to indicate the status and relationships of these taxa, but at present I can see no reason for the subordination of *R. malessanus* to any other member of the group; in facies at least it is one of the more distinct members. In this *ad hoc* treatment I accept *R. malessanus* as having as much validity as any other species of the group, despite Pau's views.

THALICTRUM FLAVUM L., Sp. Pl. i: 546 (1753).

Var. SPECIOSUM L., loc. cit. (1753).

Thalictrum speciosissimum L. in Loefl., Iter Hisp.: 303 (1758).
Thalictrum glaucum Desf., Tab. École Bot. [123 (1804), *nom. nud.*] éd. 2: 146 (1815).—Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 958 (1880).

Prov. *Jaén*: Montes de Cazorla, Barranco del Guadalentín by the Río Guadalentín, 26 June 1948, *Heywood & Davis 190* (BM).

It would be interesting to work out the exact distribution of this species and its variety in Spain. Some authors regard var. *speciosum* as a species (*T. speciosissimum* L.) separate from *T. flavum* which it is said to replace in the greater part of Spain, Portugal and North Africa. I very much doubt if the two taxa are specifically distinct, and a detailed investigation would be worth while.

PAPAVERACEAE

PAPAVER RHOEAS L., Sp. Pl. i: 507 (1753).—Lange in Willk. & Lange, Prodr. Fl. Hisp. iii: 872 (1880).—Fedde in Engl., Pflanzenr. IV. 104: 293 (1909).

Prov. *Jaén*: Montes de Cazorla, Sierra de Cazorla, between La Iruela–Cazorla road and Cuerda de las Moras, flowers light-red, more hispid plants than No. *573*, 4 July 1948, *Heywood & Davis 576* (BM).

These are more or less typical plants. The leaves show variation and tend to be less pinnatifid and more incised-dentate than usual in the species; but the leaf categories of Fedde are so indefinite as to apply to different leaves of the same plant. Our plants are *Papaver rhoeas* typical in the sense of Lange.

FUMARIACEAE

FUMARIA MACROSEPALA Boiss., Elench.: 8 (1838).—Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 880 (1880).—Cuatrec. in Trab. Mus. Ci. Nat. Barcel. xii: 287 (1929).

Fumaria megasepala Pau in Mem. R. Soc. Esp. Hist. Nat. xii: 275 (1924).

Var. OBSCURA Pugsl. in Journ. Linn. Soc. Lond., Bot. xlvii: 439 (1927); op. cit. xlix: 520 (1934).—Font Quer in Cavanillesia vi: 23 (1933).

Prov. *Jaén*: Montes de Cazorla, Barranco near Casa Forestal of La Nava de San Pedro, in *Pinetum*, flowers white with maroon tips, 25 June 1948, *Heywood & Davis 160* (BM); Cerro de Jaén, in rupestribus umbrosis, 900 m., 27 May 1928, *Cuatrecasas & Lacaita* (BM).

Prov. *Cádiz*: Ubrique, 18 June 1925, *Font Quer* (BM); Cerro de San Cristobal, Grazalema, *Gros* (BM); Cerca de Grazalema, 12 June 1922, *Gros* (BM).

Pugsley described *Fumaria macrosepala* var. *obscura* from material collected in Morocco which was notable for possessing comparatively small sepals. As one of the main distinguishing features of *F. macrosepala* is, as its name suggests, its very large sepals it is not surprising that he regarded these gatherings as worthy of varietal separation. Other characters of var. *obscura* are the smaller fruits, red-purple-tinged corollas and subacute sepals. It was later recorded for Spain by Pugsley (1934) and details of collections which he named but did not publish are given above together with a record from the Montes de Cazorla. In Spain var. *obscura* is confined to the Betic provinces, but it is probable that further gatherings will extend its known range. In the Macizo de Mágina, Cuatrecasas (1929) noted that *F. macrosepala* showed a great deal of variation in the shape of the sepals and leaves, and in habit. There both the typical variety and var. *obscura* occur, but not apparently growing together. The plants I collected in the Montes de Cazorla are ecologically distinct in growing in woodlands and not on rocks and mountain slopes. Possibly var. *obscura* deserves higher taxonomic rank; certainly it appears markedly distinct from the typical variety, but more material would be needed with distributional and ecological data before a decision could be made.

The characters of the Cazorlan plant, which agrees well with Pugsley's description, are: pedicels erect after flowering; sepals large and wide, twice as broad as the corolla, 4–5 mm. long, 2·5–3 mm. broad, ovate-lanceolate, more or less acute, with a prominent green vein, slightly serrate at the base; flowers white, purple-maroon at the tips of the petals, spur inflated curved obtuse; fruit densely but not prominently tubercled.

A similar form is *F. malacitana* Hausskn & Fritze, which Pugsley reduced to varietal status. Its sepals have approximately the same dimensions as *F. macrosepala* var. *obscura*, but it differs in its greater floribundity, and compressed ovate fruits which are not apiculate. Like var. *obscura* it is entirely Betic in its Spanish distribution.

SARCOCAPNOS CRASSIFOLIA (Desf.) DC., Reg. Veg. Syst. Nat. ii: 130 (1821).

Fumaria crassifolia Desf., Fl. Atlant. ii: 126, t. 173 (1798).

Var. SPECIOSA (Boiss.) Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 887 (1880).—Maire in Mém. Soc. Sci. Nat. Maroc xxi–xxii: 3 (1929).

Sarcocapnos speciosa Boiss., Diagn. Pl. Or. Nov. iii, 1: 14 (1853).

Prov. *Jaén*: Montes de Cazorla, Los Organos, dry overhanging limestone cliffs, flowers white with yellow centre fading pink, species spectabilis!, 27 June 1948, *Heywood & Davis 254* (BM); Sierra de Cazorla, cliffs of Aguilones de Fuente Umbría, 1,360 m., 15 June 1928, *Lacaita 447* (BM).

Sarcocapnos crassifolia shows considerable polymorphy especially in North Africa, whence Maire (1929) has described several varieties. It is, as he says, pulverized, like *Rupicapnos*, into a multitude of small local races. Boissier described the Spanish representatives of *S. crassifolia* as a distinct species—*S. speciosa*—but he has received little support for this action. Willkomm reduced *S. speciosa* to a variety of *S. crassifolia* and Maire (tom. cit.: 4) notes that it seems impossible to separate *S. speciosa* specifically from *S. crassifolia*; certain Moroccan races present the characters of the former to such a degree that one (*S. crassifolia* var. *fallax* Maire) has been mistaken by Cosson for *S. speciosa*. Generally *S. crassifolia* var. *speciosa* is distinguished by its larger flowers and fruits, and longer, more slender spurs.

It is not always easy to separate *S. crassifolia* from *S. enneaphylla* (L.) DC. In fact I am not entirely convinced of the specific distinctness of these two; none of the characters used to separate them appears to be entirely reliable. It is generally accepted that the leaves of *S. crassifolia* are less divided, once ternate, and more fleshy (but *S. enneaphylla* is quite fleshy when not growing in too shaded a habitat); the shape and size of the leaflets are too variable to be of value taxonomically. In addition the flowers of *S. crassifolia* are generally somewhat larger and the sepals ovate-lanceolate, not ovate. There are also slight fruit characters of doubtful value.

In distribution the two species are distinct. *S. enneaphylla* extends from the south of France to the south of Spain; *S. crassifolia* has a southern distribution in Spain and extends into North Africa. In south Spain, the region of overlap, the populations of the two species are more variable and difficult to separate.

SARCOCAPNOS BAETICA (Boiss. & Reut.) Nym., Consp. Fl. Eur.: 26 (1878).—Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 886 (1880) excl. var.

Sarcocapnos enneaphylla sensu Boiss., Voy. Bot. Midi Esp. ii: 18 (1839); non DC.
Aplectrocapnos baetica Boiss. & Reut. in Boiss., Diagn. Pl. Or. Nov. i, 5: 79 (1844).
Sarcocapnos enneaphylla var. *baetica* (Boiss. & Reut.) Pau in Mem. Mus. Ci. Nat. Barcel., Sér. Bot. i, 3: 7 (1925).
Sarcocapnos integrifolia var. *baetica* (Boiss. & Reut.) Cuatrec. in Trab. Mus. Ci. Nat. Barcel. xii: 287 (1929).

Prov. *Jaén*: Montes de Cazorla, Sierra de Cazorla, near Cueva de la Magdalena, shady vertical rocks, flowers white with yellowish centre, 24 June 1948, *Heywood & Davis 60* (BM); Cazorla, rocks at Cueva de la Magdalena, 31 May 1928, *Lacaita*

313 (BM); Montes de Cazorla, Agujeros de San Pedro, above the Casa Forestal of La Nava de San Pedro, shady vertical limestone rocks, 29 June 1948, *Heywood & Davis 362* (BM).

Boissier and Reuter established the genus *Aplectrocapnos* for plants collected by Boissier and by Prolongo and Haenseler in the Sierra de la Nieve. Boissier's own collection was in fruit and he named it *Sarcocapnos enneaphylla*; but later he received Prolongo and Haenseler's flowering material which led him not only to describe (with Reuter) the plants as a new genus but to propose a new subtribe of *Fumariaceae*, subtribe *Aplectreae*, characterized by the ecalcarate flowers: '*Aplectrocapnos* calcaris absentiâ inter Fumariaceas distinctissimum novam subtribum . . . constituit'. The species was named *A. baetica* and Boissier noted that besides its generic character it differed from *S. enneaphylla* by its flowers half as small again, and less divided leaves.

Later writers have disagreed about the distinctness of *S. baetica* from *S. enneaphylla*; some have regarded *S. baetica* as no more than a monstrosity of *S. enneaphylla* which itself shows ecalcarate flowers towards the end of the inflorescence (cf. Pau, loc. cit.). Cuatrecasas, on the other hand, unites *S. baetica* and *A. integrifolia* as varieties of a single species (*S. integrifolia*) in contradistinction to *S. enneaphylla*.

I am inclined to follow Cuatrecasas in so far as he retains *S. baetica* distinct from *S. enneaphylla*. From examination of material of these species in several herbaria I have concluded that the complete lack of spurred flowers is the only constant character, reinforced by more simple division of leaves, to separate *S. baetica* from *S. enneaphylla*. That the absence of spurs in *S. baetica* is a constant character[1] and, as far as I can see, bears no relation to ecological conditions as suggested by Pau, militates against its consideration as an abnormal state of *S. enneaphylla*.

The feature of the less divided leaf will not stand by itself in some cases and must be correlated with absence of a spur; it is a general character not specifically diagnostic. The leaves vary in individual plants: in my plants from the Montes de Cazorla the terminal leaf-segments are often reniform, slightly emarginate with a mucro in the hollow, subreniform or ovate-rotund; the leaf-base may be cordate, subcordate or rounded. The leaves are trisect with the segments regularly or irregularly 2–3-partite, with a range of variation in size from 0·4 to 1·2 cm. long and 0·3 to 1·1 cm. broad.

Habit differences are likewise invalid: my Cazorlan specimens are compact microphyllous clumps with more or less thick leaves, or lax elongated tenuous flopping masses with long-petiolate leaves, the latter growing in more shady and damp places.

Willkomm gives glaucous leaves as a distinctive feature of *S. baetica*: this is true of Huter, Porta and Rigo's specimens from the Sierra Prieta (No. *997*) but is variable in material from the Cazorlan mountains and elsewhere.

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[1] Rivas Goday (in An. R. Acad. Farm. Madrid vii: 39–41 (1941)) discusses the question of ecalcarate flowers and the stage of flowering, but I fail to understand his position: he collected *S. enneaphylla* in April, always apparently with calcarate flowers, but I cannot see that this indicates anything else than that *S. enneaphylla* has such flowers in spring, which is what one would expect. It has no bearing on *S. baetica*. What is required is an observation of individual plants of reputed *S. baetica* throughout their flowering season to find out whether the production of ecalcarate flowers is a seasonal phenomenon.

To summarize, besides Boissier's distinctions there is little else to differentiate *S. baetica* and *S. enneaphylla*. Willkomm's differences apply well to the specimens he saw and cited but later gatherings have weakened their importance.

Although the distribution of these two species is not yet clearly known owing to misidentified records, it is clear that *S. enneaphylla* is more northern in range (occurring in southern France) than *S. baetica*; but there is considerable overlap.

SARCOCAPNOS INTEGRIFOLIA (Boiss.) Cuatrec. in Trab. Mus. Ci. Nat. Barcel. xii: 286 (1929) excl. var.

Aplectrocapnos baetica sensu Coss., Not. Quelq. Pl.: 141 (1852); non Boiss. & Reut.
Aplectrocapnos integrifolia Boiss., Diagn. Pl. Or. Nov. iii, 1: 13 (1853).
Sarcocapnos baetica var. *integrifolia* (Boiss.) Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 886 (1880).

Prov. *Jaén*: fentes des rochers à pic dans la Sierra de Sagra près Huéscar, 12 June 1851, *Bourgeau 1017* (type; BM; E; K)[1].

In 1853 Boissier published a second species of the genus *Aplectrocapnos*, *A. integrifolia*, so named because of its simple entire leaves. Willkomm reduced it to a variety of *Sarcocapnos baetica*. Cuatrecasas accepted *S. baetica* and *A. integrifolia* as 'sinónimos subordinados', but through confusing Series 1 and Series 2 of Boissier's *Diagnoses*, and apparent ignorance of their dates of publication, he thought that *A. integrifolia* had priority of publication over *A. baetica*. Obviously he had not seen either of these publications. *A. baetica* was published in 1844, *A. integrifolia* in 1853. As a result he united the two taxa under the wrong name *S. integrifolia* (Boiss.) Cuatrec. and created the unnecessary combination *S. integrifolia* var. *baetica* (Boiss. & Reut.) Cuatrec. for *S. baetica*.

S. integrifolia is endemic to the Macizo de la Sagra and M. de Mágina; it is quite distinct in facies, and I have seen no material which is intermediate between it and *S. baetica*. I believe that the final treatment will be to regard it as a subspecies of *S. baetica*, but I should like to see more material of it.

The '*Sarcocapnos* (*Baetica* var.) *integrifolia* Willk.' (*sic*) collected by Porta and Rigo from Albacete (in rupibus pr. Alcaraz, sol. calcar., 600–700 m., 23 June 1891, No. *171*) is nothing else than typical *S. baetica*.

CRUCIFERAE

Alyssum fastigiatum Heywood, sp. nov.

Species ex affinitate *A. montani* L. sed habitu fastigiato-erecto caulibus aequilongibus, indumento virescenti, floribus minoribus, petalis sepalis sesquilongioribus (nec duplo) in sicco albicantibus, siliculis vix emarginatis, distinguitur; ab *A. parvifloro* Fisch. ex Bieb. stylo longiori, siliculis longius pedicellatis, inter alia longius distat.

Herba perennis (?) radice paullum lignoso, virescens, indumento pilorum stellatorum pubescens. *Caules* numerosissimi, fastigiato-erecti, inter se ± aequilongi, simplices, 18–24 cm. alti. *Folia* obovato-oblonga vel obovata, spathulata, apice acutiuscula, superiora lanceolata vel linearia, ad basin ± attenuata, inferiora 0·5–0.8

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[1] In the University Herbarium, Cambridge, the specimens under this label are *S. baetica*.

cm. longa, 1·5–2 mm. lata (superiora 1·4–1·8 cm. longa, (0·5–) 1·5–2·5 mm. lata). *Flores* parvi, dense corymbosi. *Sepala* decidua, ovato-oblonga, 2–2·5 mm. longa, 0·75 mm. lata, stellato-tomentosa. *Petala* sepalis sesquilongiora, in sicco albicantia, bifida. *Filamenta* longiora alata; filamenta breviora appendiculata vel ut videtur alata basi utrinque glandulis receptaculi 2 flavis. *Siliculae* in racemos elongatos 4–6 cm. longos confertae (pedicellis gracilibus patentibus 4–6 mm. longis), orbiculares, 2·5–3 mm. diametro, apice vix emarginatae sed paullum retusae, faciebus dense stellato-tomentosae, stylo 1·5–2·5 mm. longo dimidiam partem siliculae vix excedenti vel siliculam subaequanti; semina immatura suborbicularia, alata. Floret Majo-Jun.

Prov. *Jaén*: Montes de Cazorla, Pico de la Garganta, near La Nava de San Pedro, rocky places, *c.* 1,500 m., 25 June 1948, *Heywood & Davis 153* (BM, holotype; E; K).

This is a striking erect-elongate, many-stemmed species with long fruiting racemes, small flowers and silicules, and long pedicels and styles. It approaches nearest to *Alyssum montanum* L. in the character of its silicules and styles: *A. montanum* is a polymorphic species, but the new species does not agree with any of the variants I have seen. Its main points of difference from *A. montanum* are: smaller flowers, petals which are white in the dried state (not yellow), and erect fastigiate habit with stems of a uniform height. In some flowers all the stamens appear to be winged, but this is a character which has yet to be evaluated. It is a curious fact that this species shows more apparent affinity with Balkan material than with western European. In fact the specimens which I have found to approach *A. fastigiatum* most closely are from central Moravia, '*Alyssum montanum* var. *eumontanum* Baumg.: Vyskou in declivibus stepposis "Vetrniky" solo arenaceo 14 May 1926, *J. Podpera* in *Fl. Exs. Rep. Bohem. Sloven. 121*', in the Kew Herbarium. These specimens agree with the new species in elongate habit and virescent indumentum, but they differ in having larger flowers and silicules, shorter more rounded racemes, and petals remaining yellow when dry.

A. fastigiatum is further removed from *A. parviflorum* Fisch. ex Bieb., which has short-stalked silicules with short styles.

ERYSIMUM GRANDIFLORUM Desf., Fl. Atlant. ii: 85 (1798).

Erysimum longifolium DC., Reg. Veg. Syst. Nat. ii: 504 (1821), *nom. illegit.*[1]
Erysimum canescens sensu Boiss., Voy. Bot. Midi Esp. ii: 31 (1839) pro parte; non Roth.
Erysimum australe Gay, Erysim. Nov. Diagn.: 6 (1842), *nom. illegit.*, pro parte, quoad pl. occid. —Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 806 (1880) excl. specim. nonnull. quae ad *E. myriophyllum* pertinent.
Erysimum pallens sensu Boiss., tom. cit.: 716 (1845) pro parte; non Pers.
Erysimum australe var. *ramosum* Willk., tom. cit.: 807 (1880).
Erysimum australe var. *simplex* Willk., loc. cit. (1880) excl. parte.
Erysimum australe var. *alpinum* Willk., loc. cit. (1880) excl. parte.

The group to which this species belongs is one of the most involved in the south-European-Mediterranean flora. The following taxa are concerned in addition to those

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[1] Substituted for *E. grandiflorum* Desf. . . . 'non Bieb.' But *E. grandiflorum* Desf. is a legitimate name, *E. grandiflorum* Bieb. (1808) being the *later* homonym.

cited in the above synonymy: *Erysimum hieracifolium* L., *E. diffusum* Ehrh., *E. canescens* Roth, *E. pumilum* Gaudin, non DC., *E. pallens* (Hall. f. ex Schleich.) Pers., *E. helveticum* (Jacq.) DC., *E. virgatum* Roth, as well as many interpretations of these by other authors. The treatments given in standard recent floras vary to an almost incredible degree, and elucidation must await a complete monograph of the whole group. There are, however, in Spain further taxonomic problems in this group which are not directly connected with its international systematics. But before these are considered, some justification for the choice of name here used is needed.

Boissier (1839) referred the Spanish plants of this group to *E. canescens*, under which he cited *E. pumilum*, *E. helveticum*, *E. grandiflorum* (*E. longifolium*) and other names. Later (1845) he replaced *E. canescens* by *E. pallens*. Meanwhile Gay (1842) described under *E. australe* (an illegitimate name) a composite group embracing *E. grandiflorum* Desf. (*E. longifolium* DC.), *E. linariaefolium* Tausch and *E. stoechadifolium* Tausch, inhabiting as he said 'per regionem Mediterraneam ferè omnem'.

Obviously, as *E. australe* Gay was substituted for more than one earlier legitimate name, it was only a matter of time before it was deposed by a simple application of the law of priority. Gradually the name *E. bocconi* Pers. was adopted by workers on the Spanish and North African flora. But Persoon's name, based on *Cheiranthus boccone* All. = *C. helveticus* Jacq., applies to a plant from the Swiss and Italian Alps, and Gay quoted *E.* '*Boccone* All. . . . partìm et saltem quoad plantam Nicaeensem'. It is obvious then that *E. bocconi* Pers. is not the same as the Mediterranean species envisaged by Gay.[1] A further complication is that *E. australe* of Spanish authors is not the same as *E. australe* Gay as widely interpreted, although it is extremely difficult to say how it differs unless a revised conception of the whole group is put forward. To state this in another way, *E. australe* as defined by Gay is a wide-ranging superspecies comprising an undefined number of subgroups; on the other hand, the Spanish *E. australe*, to which should be linked that of south France and North Africa, forms a group by itself for which the earliest legitimate name is *E. grandiflorum* Desf. (one of the names cited by Gay under *E. australe*), the type of which came from Algeria. I must leave to a future monographer to decide whether this Franco-Iberian-African taxon will retain its specific rank or whether it will be reduced in status to a subspecies or variety of a wide-ranging equivalent of *E. australe* Gay.

Willkomm (1880) described three varieties of *E. australe* from Spain—var. *ramosum* (which is typical *E. grandiflorum*), var. *simplex* and var. *alpinum*—based largely on habit differences. These appeared to have distinct distributions—var. *ramosum* restricted to north and central Spain, var. *simplex* to Castilla la Vieja, and var. *alpinum* to Andalucia. I have studied a large amount of material (cited in part below) of this species and can find no taxonomic significance in the varieties. Their distributions actually overlap—frequently two or more forms grow on the same hill-side, and the so-called varieties are no more than habitat forms. The var. *alpinum* almost certainly does not have a genetic basis—it is a modification found at high altitudes and merges almost imperceptibly into var. *simplex* or even into var. *ramosum*. Likewise there are transitions between var. *simplex* and var. *ramosum*. Willkomm's var. *alpinum* is admittedly confined to Andalucia, almost to the Sierra Nevada in fact, but that is

[1] *E. bocconi* Pers. is, correctly, *E. helveticum* (Jacq.) DC.

surely only because the mountains there are sufficiently high to produce altitudinal modifications.

In the selection of specimens given below I have indicated the variants (in the sense of Willkomm) to which they belong, thus: *T* = typical (*ramosum*), *S* = *simplex*, *A* = *alpinum.*

Prov. *Jaén*: Sierra de Cazorla, on the way to Jilillo, on same hill-side as No. *328* but quite distinct, 31 May 1928, *Lacaita 329* (BM) *T*; bois de la Sierra de Segura, 17 June 1850, *Bourgeau 545* (K) *S*.

Prov. *Granada*: loc. lapidos. rupestribus in Sierra Prieta, Tejeda et Nevada, sol. calcar., 1,000–2,000 m., June–July 1879, *Huter, Porta & Rigo 464* (BM; C; K) *S*—mixed with specimens approaching *A*[1]; in arenosis montium Granatensium usque ad 2,400 m., aest. 1837, *Boissier* (BM; K) *S*—curious myriophyllous form; Sierra Nevada, région alpine, au Picacho de Veleta, 5 July 1851, *Bourgeau 1018* (K, syntype of *E. australe* var. *alpinum*) *A*; Sierra Nevada, région montagneuse au Cortijo de la Víbora, 15 July 1851, *Bourgeau* (K) *S*; Sierra Nevada, in pascuis glareosis ad Peñón de San Francisco, sol. schist., 2,100–2,200 m., July 1891, *Porta & Rigo Iter III Hisp. 552* (K) *A*.

Prov. *Cádiz*: Sierra de la Nieve, sur les rochers calcaires, 5 June 1889, *Reverchon Pl. d'Andal. 433* (BM; K) *T–S*—det. *E. australe* var. *simplex* by Lange.

Prov. *Alicante*: Sierra del Carrascal, slopes of Maigmó between Agost and Castalla, 10 May 1928, *Ellman & Sandwith* (K) *S*.

Prov. *Zaragoza*: Calatayud, rochers ensoleillés, May 1909, *Vicioso* (BM)—a pseudo-myriophyllum form.

Prov. *Barcelona*: Le Montserrat, Catalogne, 13 June 1889, *St. Lager* (K) *T*—curious form rooting twice on the same stem.

Prov. *Lerida*: Seo d'Urgel, vallée de la Segre, July 1847, *Bourgeau 679* (K) *T*.

Prov. *Gerona*: Figueras, rivières de la Muga, 26 May 1847, *Bourgeau 680* (K) *T*.

In addition I have seen material from the provinces of Almería (Cerro del Orto), Teruel, Castellón (Peñagolosa), Murcia, Albacete, Soria and Burgos (Sierra de Obarenes) which confirms the mixed distribution of Willkomm's varieties as indicated above.

Some paramorphs of *E. grandiflorum* closely resemble *E. myriophyllum* in habit—these pseudo-myriophyll varieties are discussed below under that species.

Coutinho (Fl. Portug., ed. 2: 303 (1939)) records two varieties of *E. bocconi* from Portugal in addition to the type: var. *henriquesii* Cout. and var. *minus* Cout. The latter, with 'flowers a little smaller, leaves narrowly linear, conduplicate (in the dried state); plant of 2–3 dm. simple or little-branched', suggests an alpine form equivalent perhaps to *E. australe* var. *alpinum*. Likewise from North Africa several variants have been described.

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[1] A sheet of this number in the Kew Herbarium bears two species—*E. grandiflorum*, and what is probably a young form of *E. myriophyllum* with very crowded leaves and little space between the leaves and inflorescence.

Erysimum myriophyllum Lange in Vidensk. Medd. Naturhist. Foren. Kjøbenh. 1881: 102 (1882).—Willk., Ill. ii: 132, t. 168 (1892).

Erysimum canescens sensu Boiss., Voy. Bot. Midi Esp. ii: 31 (1839) pro parte; non Roth.

Erysimum pallens sensu Boiss., tom. cit.: 716 (1845) pro parte; non Pers.

Erysimum australe var. *simplex* Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 807 (1880) pro parte.

Erysimum australe var. *alpinum* Willk., loc. cit. (1880) pro parte.

Erysimum simplex Pau in Mem. Mus. Ci. Nat. Barcel., Sér. Bot. i, 1: 20 (1922) quoad syn. *E. myriophyllum.*

Prov. *Jaén*: Montes de Cazorla, Sierra de Pozo Alcón, Pico de Cabañas, limestone slopes, flowers canary-yellow, 1 July 1948, *Heywood & Davis 461* (BM) *A*[1]; Sierra de Cazorla, on the way to Jilillo, on same hill-side as No. *329* but quite distinct, 31 May 1928, *Lacaita 328* (BM); Sierra de Cazorla, pinewoods above Arroyo Maillar, 14 June 1927, *Lacaita 291* (BM); above Cazorla, near Arroyo Maillar, locality 9 of 14 June 1927, *Wilmott* (BM); above Cazorla, Peñón Morondo, locality 6 of 14 June 1927, *Wilmott* (BM).

Prov. *Granada*: Sierra Tejeda, loc. arenoso-glareosis parte septentrion. sol. dolomitico, 1,300–1,500 m., 21 June 1879, *Huter, Porta & Rigo 463* (isotype; BM; C; K)—typical or intermediate to *A*; Sierra Tejeda, glareoso-dolomiticis partis occident., 1,600–1,800 m., 8 July 1895, *Porta & Rigo Iter IV Hisp. 32* (K); Sierra Tejeda, 16 June 1864, *del Campo* (BM; K)[2]; Sierra Nevada, in cacumine Picacho de Veleta, 27 June 1851, *Ball* (K) *A*—small depauperate immature plants.

Prov. *Almería*: Sierra de Baza, région alpine, dans les rochers, 20 June 1851, *Bourgeau 1551* (C; K).

As an indication of the involution of this species it may be noted that the Cazorla gathering *Heywood & Davis 461* closely matches the syntype specimen of Bourgeau from the Sierra de Baza (No. *1551*) of *E. australe* var. *alpinum* Willk.! In his *Illustrationes* Willkomm pointed out that his varieties *simplex* and *alpinum* of *E. australe* were mixed, containing forms of both *E. australe* (i.e. *E. grandiflorum*) and *E. myriophyllum.* The Bourgeau plant just mentioned was, along with others, transferred to *E. myriophyllum* by Willkomm, but although he explained that both *E. myriophyllum* and *E. australe* possessed alpine forms he did not describe that of *E. myriophyllum.* Likewise with his *E. australe* var. *simplex*: Willkomm did not describe any corresponding variety of *E. myriophyllum.* This was perhaps as well, for the same position obtains in *E. myriophyllum* as does in *E. grandiflorum*—the variants merge into one another and only the extreme forms are sufficiently distinct as to be separable.

The method of growth of *E. myriophyllum* is curious—the rosettes of canaliculate leaves appear to form each year higher up the stem until there are as many as four or five distinct withered rosettes on each stem. It would seem at first sight that flowering does not take place until the third or fourth year of growth, but this is not so, at least not in all plants, for I have seen one- or two-year old plants, with a corresponding number of rosettes, bearing flowers. If these early-flowering plants develop into the typical form with several rosettes per stem, continued growth must be by axial buds and the stem a false axis or pseudomonopodium. The young forms are not very characteristic in this species, and many specimens which seem intermediate between *E. myriophyllum* and *E. grandiflorum* are probably immature *E. myriophyllum*. There are none the less paramorphs of *E. grandiflorum* which simulate the habit of *E. myriophyllum* in having densely crowded basal leaves almost forming rosettes, but these can be separated by their shorter and laxer racemes, the presence of a naked stem subtending the inflorescence, and by the direction of the siliques.

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[1] *A* = alpine form.

[2] The Kew Herbarium material is somewhat intermediate to *E. grandiflorum*; another sheet is of an alpine form.

The major taxonomic problem in this species is its specific distinctness from *E. grandiflorum*. Willkomm gives as differential characters: unusual habit, leaves always canaliculate and filiform, and siliques dressed parallel to the axis and not spreading. Lacaita (in herb.) asserts that *E. myriophyllum* is not a form of specific rank: 'the behaviour of the leaves is parallel to that of some specimens of *E. linifolium* from very dry spots near Jaén which in such conditions also become "myriophyll".' But the behaviour of the leaves is not entirely or even largely due to habitat, else *E. grandiflorum* when growing together with *E. myriophyllum* would assume the same habit; and, as Lacaita admits, this is not so, for on the same hill-side they remain distinct.

An important diagnostic character of *E. myriophyllum* is the crowding of the leaves so as to cover up the stem to the base of the inflorescence, and the racemes themselves are long with crowded siliques. The result of this is that there is little or no naked stem between the leaves and the inflorescence, thus contrasting with *E. grandiflorum*, where the leaves are much more sparse and there is a long leafless stem subtending the inflorescence which is less crowded with siliques.

The angle at which the siliques are borne on the axis is quite a good differential feature but not always reliable. In *E. myriophyllum* the pedicels are almost erect and curve in at their apex so that the siliques lie more or less closely appressed to the axis. The pedicels in *E. grandiflorum* are much more spreading—they grow out before curving upwards and the siliques grow out at an angle, or if parallel to the axis they are at some distance from it and not more or less appressed to it.

Pau (1922) makes a series of errors about this species. He gives as a synonym *E. australe* var. *simplex*, which is only true *pro parte* as indicated above; and he therefore replaces *E. myriophyllum* by the name *E. simplex* because the epithet *simplex* is earlier. Apart from the inapplicability of this name it is in contravention of the International Code, for *myriophyllum* is an earlier *specific* epithet than *simplex*. Finally his synonym *E. nevadense* Reut. 'por la localidad atribuída por Reuter': certainly *E. nevadense* 'var. *stenophyllum*' Reut. herb. refers to *E. myriophyllum*, but *E. nevadense* itself is a doubtful species, as explained below.

E. myriophyllum is confined in its distribution to south and south-east Spain. Pau says he does not know of examples of it except from the Sierra Nevada and S. Tejeda, but the species has a much wider range than he believed. In addition to the citations given above, *E. myriophyllum* has been recorded (by Willkomm) from the Sierra de Chiva, S. de Mariola, S. de Espuña, S. de Mijas, S. de Lujar, S. de la Nieve and S. Segura. How many of these do in fact pertain to *E. myriophyllum* is questionable as a certain confusion and misunderstanding arose when Willkomm added and subtracted localities in his withdrawal of *E. myriophyllum* from his *E. australe* (i.e. *E. grandiflorum*). This distribution should be compared with that of *E. grandiflorum* given above.

ERYSIMUM NEVADENSE Reut., Cat. Grain. Jard. Bot. Genève (1855); in Linnaea xxviii: 355 (1856).

Erysimum canescens sensu Boiss., Voy. Bot. Midi Esp. ii: 31 (1839) pro parte, fide Reut.; non Roth.

Prov. *Granada*: Sa. Nevada Hispaniae australis inter Juniperos nanas reg. super. prope Cueva del Panderón etc., *fide* Reuter (type).

Prov. *Alicante*: Sierra Mariola, près Alcoy in lapidosis, 17 June 1862, *Leresche* (K)—det. *E. nevadense* by Reuter himself; Sierra Mariola, reg. infer., July 1858, *Boissier & Reuter* cum nota in manu J. Gay 'Boissier mittebat 2 Jul. 1859' (K).

I have not seen the type of *Erysimum nevadense*, but specimens collected by Leresche and named by Reuter as *E. nevadense* seem to me no more than narrow-leaved forms of *E. grandiflorum*, intermediate in habit between Willkomm's *E. australe* vars. *simplex* and *alpinum*. Reuter's description does not give any valuable differences to separate it from *E. grandiflorum*: 'Ab *E. australi* Gay (i.e. *E. grandiflorum*) habitu graciliori, foliis angustioribus basi magis attenuatis, siliquis brevioribus teretiusculis duplo tenuioribus, seminibus dimidio minoribus subcompressis differt *et immutata cultura manet*[1].'

It is possibly a genetically depauperate variety of *E. grandiflorum*, but I should like to see more material of it before reducing it to synonymy. Almost certainly it is conspecific with *E. grandiflorum*; possibly Reuter described it as a new species before the range of variation of *E. grandiflorum* was known. The Boissier and Reuter specimens cited above are advanced in fruit, and more or less leafless except at the base, and I should name them *E. grandiflorum* corresponding to Willkomm's *E. australe* var. *simplex*. The fruits do not at all agree with the original description; on the contrary the siliques are as long and wide as is usual in *E. grandiflorum*.

ERYSIMUM DURIAEI Boiss., Diagn. Pl. Or. Nov. iii, 1: 26 (1853).—Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 806 (1880).

Prov. *Oviedo*: in rupib. apricis prope Puente Gallegas, nec alibi obvium, 5 June 1835, *Durieu Pl. Select. Hisp. Lusit. Sect. Astur. 407* (type; BM; K).

Although Boissier described the siliques of this species as terminated by minute capitate stigmas, in the isotypes I have seen the stigmas are clearly bilobed-emarginate. For this reason *Erysimum duriaei* should be placed in Sect. *Cheiranthopsis* not Sect. *Euerysimum*. This is supported by the facies of the plant which resembles *E. grandiflorum* and *E. linifolium*.

ERYSIMUM LINIFOLIUM (Pers.) Gay, Erysim. Nov. Diagn.: 3 (1842).—Coss., Not. Quelq. Pl.: 96 (1851).—Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 807 (1880).

Hesperis linifolia Pourr. ex Desf., Tab. École Bot.: 129 (1804), *nom. nud.*

Cheiranthus linifolius Pers., Synops. Pl. ii: 201 (1806).—Gay in Ann. Sci. Nat., Sér. 2, Bot. vi: 129, 133 (1836).

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[1] My emphasis.

Erysimum linifolium is a variable species, and one which has received little attention from Spanish botanists. After making a detailed study of the species I came to certain conclusions which I found to agree in some part with those given by Lacaita in an unpublished note in his herbarium (at the British Museum). What follows here is my original work, but I have added the essence of Lacaita's observations on the nomenclature of *E. linifolium* after checking them to my satisfaction.

Hesperis linifolia Pourr. ex Desf. is a *nomen nudum*. The earliest legitimate name is therefore *Cheiranthus linifolius* of Persoon, who quotes '*Hesperis linifolius*. H.P.' and says 'Hab. in Hispania. Pourret', which is sufficient to establish that Persoon's species is the Asturian plant, i.e. the one discussed by Gay in his *Duriaei iter Asturicum Botanicum* (1836) under Persoon's name, though he subsequently transferred it to *Erysimum* in his *Erysimorum quorumdam Novorum Diagnoses*.

Here is what he has to say in the *Iter* (pp. 133–134): 'Mentione propriâ dignus *Cheiranthus linifolius* Pers., per totum ferè annum florens stirps, floribus violaceis odoratisque decora, in hortis olim culta, quoad patriam germanam hucusque valdè dubia, nunc verò certam civitatem nacta, utpote ad vias, quas maximè exornat, circa Canicam frequentissima. Ex inferiore Asturiâ venienti, ad vicum *el Puelo* primùm occurrit, undè per subjectam convallem se spargit. Angustissimis tamen limitibus circumscribitur, nec post Canicam, in Narceiae convalle, ultrà tres leucae quadrantes progreditur, dùm in valle *del Naviego* leucam unam et dimidiam vix aequat. Clivos tamen utriusque convallis, secùs vias, eò usque scandit, dùm altitudinem ferè montis attigit, quo vicus *el Puelo* insidet. Cujus, singulari statione florisque elegantiâ maximè allectus, seminum copiam attulit Duriaeus, undè novum hortis nostris ornamentum pararet.'

Rothmaler (in Fedde, Repert. Sp. Nov. xlix: 179 (1940)) following the opinion of Popov (in Sched. Herb. Fl. As. Med. iv: n. 91 (1925)) divides *E. linifolium* into two species: *E. linifolium* (*sensu stricto*) from Portugal, Galicia, León and New Castille, and *E. popovii* from the provinces of Murcia, Jaén, Almería, Granada and Málaga. This agrees with my own researches in that the plants of the first group form a distinct northern population (although I disagree with his inclusion here of the specimens from Sierra Morena which correspond to *Hesperis repanda* Lag. = *E. linifolium* var. *lagascae*), but his second group (*E. popovii*) is, in my opinion, a mixture of two distinct taxa which are not, separately or jointly, specifically separable from *E. linifolium*. My views are here set out in detail.

Subsp. **linifolium**.

Erysimum linifolium (Pers.) Gay *sensu stricto* et auct. fl. hisp. quoad pl. septentr.—Rothm. in Fedde, Repert. Sp. Nov. xlix: 180 (1940) excl. specim. ex Sierra Morena.

Caules usque ad 50 cm. alti, saepe flexuosi, usque ad flores foliati. *Folia* 1–2 mm. lata (in pl. Astur.) vel 1·5–3·5 mm. lata (in pl. Legion. et Castil.); folia basalia atque inferiora dentata. *Inflorescentiae* caulibus breviores, floribus 12–16 mm. longis. *Sepala* (5–) 7–8 (–9) mm. longa. *Petalorum* limbi 7–12 mm. longi. *Styli* 1·5–3 mm. longi.

Prov. *Oviedo*: ad aggeres viarum in valle Cangas de Tineo, freq., Jul. (sed floret vere) 1835, *Durieu Pl. Select. Hisp. Lusit. Sect. Astur. 400* (BM; C; K); rochers inter Corias et Cangas de Tineo au bord de la route et de la rivière, fl. 28 May, fr. 22 July 1864, *Bourgeau 2593* (K); bords du torrent et des routes à Cangas de Tineo et Coria, 28 May, 22 July 1864, *Bourgeau 2592* (BM); in arenosis ad Cangas de Tineo, 17 July 1878, *Levier* in *Boissier, Leresche & Levier* (K); Corias, 22 July 1864, *du Parquet* (BM); near Cangas de Tineo, in scree, fl. pallide lilacinis, 15 July 1927, *Lacaita 596* (BM) and *Wilmott* (BM).

Prov. *Orense*: Orense, 21 May 1876, *Winkler* (K).

Prov. *Salamanca*: Salamanca, near the bridge of Mozodiez, 12 km. north of town, in aridis, flowers rich purple, 18 May 1923, *Lacaita 84* (BM); Salamanca, prope pagum Aldeaseca, in saxosis, 5 June 1925, *Lacaita 451* (BM).

Prov. *Toledo*: San Pablo de los Montes, env. de Toledo, 15 June 1854, *Bourgeau* (K).

Prov. *Avila*: Sierra de Gredos, in saxosis del Puerto del Pico prope Serranillos pagum, *Graells* (K).

This—the typical—subspecies could be divided into two forms—a narrower-leaved Asturian form and a broader-leaved form covering the plants from León and Castille—but they would be very difficult to characterize satisfactorily. The Asturian plants as a population with uniform moist climate conditions differ, but only slightly, from the other groups of the subspecies.

Subsp. **baeticum** Heywood, subsp. nov.

Erysimum popovii Rothm. in Fedde, Repert. Sp. Nov. xlix: 180 (1940) pro max. parte, excl. specim. ex Sierra de Cazorla, S. de Cabrilla et S. de la Malesa.

Erysimum linifolium auct. hisp. quoad pl. baetic.

Caules (10–) 15–35 (–40) cm. alti. *Folia* mire variabilia, in exemplis nonnullis (e locis Gienn.) inferiora illis *Erysimi myriophylli* subsimilia, basalia atque inferiora dentata vel remote dentata, 0·5–4 mm. lata. *Inflorescentiae* longitudine caules paullum aut multum excedentes, floribus 14–20 mm. longis, in fructu siliquis magis confertis quam in praecedenti. *Sepala* 7–11 mm. longa. *Petalorum* limbi 8–13 mm. longi. *Styli* 2–6 mm. longi.

Var. **baeticum** Heywood, var. nov.

Varietas subspeciei typica, calyce purpureo, petalis oblongis apice rotundatis, inflorescentiis longitudine variabilibus.

Prov. *Jaén*: on rocks south-west of Jaén, 21 May 1926, *Ellman & Sandwith 755* (K); Jaén, in saxosis montanis, 18 May 1925, *Lacaita 292* (BM); rocks of the Sierra above Jaén, locality 8 of 10 June 1927, *Wilmott* (BM); screes below rocks of the Sierra above Jaén, locality 7 of 10 June 1927, *Wilmott* (BM).

Prov. *Granada*: on slopes and summit of Mt. Cerro Calar, 16 km. south-east of Granada, 24 May 1924, *Ellman & Hubbard 836* (K)—with alpine form.

Prov. *Almería*: Sierra Nevada, between Minas de Beiras and Cerro de Almirez, high up on main ridge, 30 June 1926, *Lofthouse* (BM); Sierra Nevada, main ridge west of Cerro del Rayo, 25 June 1926, *Wilmott & Lofthouse* (BM); from Cerro del Rayo west to next peak, at next peak, 22 June 1926, *Lofthouse* (BM); Sierra

Nevada, between Minas de Beiras and Cerro de Almirez, 2,100–2,400 m., 6 June 1924, *Lofthouse* (BM); Cerro Almirez, versant nord, 5 July 1908, *St. Lager* (K, holotype; Herb. Geneva); Sierra de Baza dans la région montagneuse inférieure, 20 June 1851, *Bourgeau 1020* (K); Vélez-Rubio, rocky slopes of Sierra de María, 6 May 1926, *Ellman & Sandwith 361* (K).

Subsp. *baeticum* is sufficiently distinct in facies from the northern populations of *E. linifolium* as to deserve recognition as a geographical subspecies. Its populations are much more variable in leaf-shape (especially width) and in size of flower, fruit and style than the northern ones (subsp. *linifolium*). The representatives from the vicinity of Jaén deserve special mention and are discussed later in the general consideration of the variation of *E. linifolium*. Var. *baeticum* is the typical form of the subspecies.

Var. **lagascae** (Riv. God. & Bell. Rodr.) Heywood, comb. et stat. nov.

Hesperis repanda Lag., Gen. & Sp. Pl.: 20 (1816); non *Erysimum repandum* L. (1753).

Erysimum linifolium sensu Rothm. in Fedde, Repert. Sp. Nov. xlix: 180 (1940) quoad specim. ex Sierra Morena.

Erysimum lagascae Riv. God. & Bell. Rodr. in An. Jard. Bot. Madrid vi, 2: 116, fig. 24 (1946).

Varietas calyce atropurpureo, petalis oblongis apice truncatis, inflorescentiis fructiferis elongatis caules aequantibus vel excedentibus.

Prov. *Ciudad Real*: Sierra Morena, Venta de Cárdenas, 24 Apr. 1877, *Joad* (K); Sierra Morena, in faucibus Despeñaperros in saxosis apricis, 20 May 1925, *Lacaita 314* (BM).

Lagasca described *Hesperis repanda* from the Sierra Morena in 1816 and since then there has been some doubt about its identity and status. Willkomm (Ill. ii: 132 (1892)) expressed doubt about its specific rank, but he was writing in belief that the Sierra Morena plant had not been rediscovered. He observed: 'La *Hesperis repanda* Lag. se ha reunido á esta especie quiza sin razon. Pues segun la descripcion que Lagasca añade á la corta diagnose de su especie, esta planta de Sierra Morena tiene una espiga de flores mas larga que el tallo, sepalos de color de púrpura negruzca y pétalos morados y truncados.' Lagasca's original description was: '*Planta* herbacea, perennis, subpedalis, livida, pilis albis, brevibus, retroversis, adpressis scabriuscula.—*Caulis* erectus, subangulatus, superne tetragonus.—*Florum* spica terminalis, multiflora, elongata, caule longior. *Calyx* atropurpureus. *Corolla violacea* petalis oblongis truncatis calyce longioribus. Habit. in Montibus Marianis.'

Lately Rivas Goday and Bellot Rodriguez (1946) in their study of the flora and vegetation of the Despeñaperros-Santa Elena region (Sierra Morena) collected Lagasca's plant several times and decided that it was of specific rank. I have not been able to find the plant myself at Despeñaperros, probably because the time of my visit was too late (August), but I have seen Lacaita's and Joad's material of it and also the material collected by Rivas and Bellot in Sierra Morena (Herb. Fac. Farmacia, Madrid), and I cannot follow the Spanish authors in maintaining it as a species. Lacaita (in manuscript) grouped it together with the gatherings from Jaén and elsewhere in the south as a southern form (*forma*) of *E. linifolium*, but in doing so he ignored the only characters which make Lagasca's plant at all recognizable as a taxonomic entity *per se*.

The three differential characters accepted by Rivas and Bellot are:

(1) The raceme is longer than the stem, contrasting with, as Willkomm says, 'the flowers of *E. linifolium* [which are] always disposed in a short corymb'. There are two points to be cleared up here: firstly the corymbs of *E. linifolium* are variable in length and even from the *locus classicus* may be up to 6 cm. long (as in *Lacaita 596*); and secondly the inflorescence elongates considerably in fruit and often becomes longer than the stem. Moreover, in Rivas and Bellot's photograph (fig. 24) the plant on the left in flower has a raceme fairly elongated but much shorter than the stem, while that on the right shows a fruiting raceme which is much longer than the stem. This agrees with the material I have seen, and does not differ materially from other Betic specimens. The character cannot be used to separate the Sierra Morena plant from the rest of the southern (Betic) paramorphs of *E. linifolium*: the distinction the Spanish authors are trying to draw is not real for the Sierra Morena plant *qua* endemic.

(2) The coloration of the 'parts of the perianth'. By this is meant presumably that the calyx is blackish-purple, but it is not a good taxonomic character and intermediates exist. The petals are described by Lagasca as violet, and they vary in general from bright reddish-purple to lilac, depending on the habitat.

(3) The petals are oblong-truncate. This seems to me to be the only character of any value possessed by the Despeñaperros plant, but even when correlated with sepaline and petaline colouring it does not in my opinion warrant specific segregation. At the most, *E. lagascae* may be regarded as a local variety in the southern populations of *E. linifolium*.

Subsp. **cazorlense** Heywood, subsp. nov.

Erysimum popovii Rothm. in Fedde, Repert. Sp. Nov. xlix: 180 (1940) pro min. parte, quoad specim. ex Sierra de Cazorla, S. de Cabrilla et S. de la Malesa.

A subsp. *linifolio* habitu unicauli, caule simplici vel paullum ramoso, foliis basalibus rosulas distinctas persistentes foliorum integerrimorum repandorum conduplicatorum vel planorum formantibus, foliis caulinis valde confertis usque ad inflorescentiam, racemo denso congesto, infructescentia elongata siliquis numerosis confertis axi adpressis vel erectis *E. myriophyllum* Lange simulanti, valde distincta.

Caules 15–80 cm. alti. *Folia* angusta vel lata, basalia integerrima vel raro remote et obsolete subdentata. *Inflorescentia* caulem foliatum aequans vel superans, floribus violaceis 14–16 mm. longis. *Sepala* 6–8 (–9) mm. longa. *Petalorum* limbi 8–9 (–11) mm. longi. *Styli* 2–6·5 mm. longi.

Prov. *Jaén*: Montes de Cazorla, Barranco del Guadalentín above Río Guadalentín, flowers violet, chalky slopes above the river, 26 June 1948, *Heywood & Davis 182* (BM, holotype; E; K); Montes de Cazorla, Barranco de Ginés to Las Empanadas, Sierra de la Cabrilla, limestone slopes, rocks, 28 June 1948, *Heywood & Davis 314* (BM); Sierra de Cazorla, shoulder of Las Empanadas, *c.* 1,900 m., 16 June 1928, *Lacaita 465* (BM); above Cazorla, near Puerto de Jilillo, locality 6a of 15 June

1927, *Wilmott* (BM); Sierra de la Maleza ('Malessa'), lieux arides sur le calcaire, 1,800 m., June 1904, *Reverchon 1103* (Herb. Jard. Bot. Madrid); Sierra de la Cabrilla, lieux arides et calcaires. 1,700 m., June 1905, *Reverchon 1103* (Herb. Jard. Bot. Madrid).

The Cazorlan plants are quite distinct in facies from subsp. *baeticum*: they are distinguished by their caespitose single-stemmed habit, distinct rosettes of entire markedly recurved leaves which may be conduplicate or flat, the stems which are densely leafy as far as the inflorescence, the dense crowded racemes which are elongated in fruit with appressed and conferted siliques; and the siliques which are terminated by very long styles 2–6·5 mm. long. They show some variation in height, and width of leaves, but retain their characteristic appearance.

Pau (Carta 1: 2) saw Reverchon's 1903 collection of *E. linifolium* from Jaén Province (No. *1103*) and recognized it as a large-flowered variety of *Cheiranthus linifolius*: 'Difiere del tipo por las flores doble mayores, hojas enteras. De la *Hesperis repanda* Lag. . . . por no conformarse con la descripción'. The flowers (given by Pau as having sepals 10 mm., petals 15–20 mm.) are certainly not twice as large as in the other paramorphs of this species. Pau fails to emphasize all but one (entire basal leaves) of the Cazorlan plants' significant characters, although he does cover them in his description.

Subsp. *cazorlense* is of much more taxonomic value than the taxon (var.) *lagascae*, and I think that it must be at least regarded as a separate subspecies. It is possibly even a distinct species and this question is discussed later.

The variations of *Erysimum linifolium* considered as a whole fall into the following groupings as described above.

I. subsp. *linifolium*	Galicia, Asturias, León, Castille, Portugal
II. subsp. *baeticum*	Betica
var. *baeticum*	Betica
var. *lagascae*	Sierra Morena
III. subsp. *cazorlense*	Montes de Cazorla

This disposition of variants has been arrived at after tabulating the variations in the taxonomic characters that seemed to be important. In the accompanying table the specimens are arranged geographically, corresponding with the subspecies and varieties recognized. For leaf-width I have chosen four arbitrary categories, thus:

N = 0·5–1 mm. n = 1–1·5 mm. b = 1·5–2 mm. B = 2– . . . (4) mm.

It has not been possible to include characters of the silique and seed as not all specimens examined possessed these. In the tabulation all significant variations are shown in italics. The following points may be noted. (1) Topoclinal variation is shown by only one character—increase in style-length from north to south. A curious fact is that only the upper limit of measurement shows variation while the lower limit is more or less constant. (2) While there is no topoclinal variation in the other characters, they show much more variation in the southern populations than in the northern. (3) The plants from the precincts of Jaén may perhaps be separated out as a geographical variety: the leaves are very narrow (0·5–1·5 mm.) and the styles are very long (4–6 mm.). But I have not seen sufficient material of them to be confident of their taxonomic status. (4) The Cazorlan populations, while fitting into the general lines of variation as Betic plants, have additional characters which make them quite distinct. Their resemblance to *E. myriophyllum* is remarkable and an analogy might quite well be drawn between the relationship of *E. grandiflorum* to *E. myriophyllum* and *E. linifolium* subsp. *baeticum* to subsp. *cazorlense*. I might here be accused of inconsistency for not treating subsp. *cazorlense* as a species separate from *E. linifolium*, but in defence I would point out that one is dealing with a very different pattern of variation in *E. myriophyllum*—there the variants are sporadic in occurrence and do not fit into a geographical pattern. Until more observations are made of the Cazorlan plants I think they should be included in the framework of subspecies of *E. linifolium*.

As in *E. myriophyllum* there are 'pseudo-forms' of subsp. *cazorlense*. For example, in the collections of subsp. *baeticum* made by Wilmott and Lofthouse in the Cerro del

Variation in Erysimum linifolium

		Character						
Collection		*Height in cm.*	*Basal leaves*	*Leaf-width*	*Flower-length in mm.*	*Petal-limb length in mm.*	*Sepal-length in mm.*	*Style-length in mm.*
1. Orense	*Winkler*	23	toothed	b–B	13–14	7–8	7	2–2·5 (imm.)
2. Asturias	*Durieu*	25–35	toothed	n–b	14	8–10	5–8	1·5–2
3. Asturias	*Bourgeau*	*c.* 30	± toothed	n–b	14–16	10–11	7	2–2·5
4. Asturias	*Levier*	30–35	± toothed	n–b	15	7–9	7	2–2·5
5. Asturias	*Lacaita*	45–50	toothed	n–b	15–16	9–10	7	2–2·5
6. Salamanca	*Lacaita*	20–30	toothed	N–n	12–15	7–9	6–8	2–2·5 (imm.)
7. Salamanca	*Lacaita*	15–30	± toothed	n	14–15	8–10	7	2–3
8. S. Gredos	*Graells*	*8–16*	± toothed	b (–B)	14–16	10–12	8–9	2–3
9. Toledo	*Bourgeau*	30–35	± toothed	b–B	13–16	8–9	8	2–3
10. Morena	*Joad*	20–30	toothed	b–B	14–15	7–8	7–8	2–3 (imm.)
11. Morena	*Lacaita*	30–40	toothed	n–b	13–16	7–11	7–8	2·5+ (imm.)
12. Jaén	*Ell. & Sand.*	25–35	toothed	*N*	15	8–10	8	*5–6*
13. Jaén	*Lacaita*	15–40	± toothed	N–n	15–18	10–12	8–10	*4–6*
14. Jaén	*Wilmott*	25–35	toothed	N–n	14–15	8–9	7–8	*4–6*
15. Granada	*Ell. & Hubb.*	(15) 25–35	± entire	N–b	14–15	10	7–9	*2–4*
16. Almería	*St. Lager*	25–35	toothed	*B*	15–17	11–12	9–10	*3–4*
17. Baza	*Bourgeau*	20–25	toothed ± entire	b n–b	*18–20*	12–13	8–*11*	*3–4*
18. Vél.–Rub.	*Ell. & Sand.*	(5)–15	toothed	*B*	14	9–10	9	—
19. Minas	*Lofthouse*	15–30	toothed	n–b	15–16	9–11	7–8	*2–3·5*
20. C. Rayo	*Wil. & Loft.*	10–15	barely toothed	n–B	14–16	8–10	8	*2·5–3·5*
21. Cazorla	*Lacaita*	15–20	*entire*	n–b	15–16	9–11	7–8	*2·5–4+*
22. Cazorla	*Wilmott*	40–80	*entire*	b–B	15–16	8–9	8–9	*5–6·5*
23. Cazorla	*H. & D.: 182*	30–65	*entire*	*N*	14–15	8–9	6–8	*2–4*
24. Cazorla	*H. & D.: 314*	20–30	*entire*	n–b	14–15	8–9	6–8	*2·5–4*

N.B. All measurements have been made from dried material.

Rayo in 1926 there are plants with more or less entire basal leaves, dentate remotely, but the rosettes are very loose and not at all typical of subsp. *cazorlense*.

Finally it should be noted that the Portuguese plants of *E. linifolium* that I have seen (from the region of the Douro) agree with subsp. *linifolium*.

RORIPPA NASTURTIUM-AQUATICUM (L.) Hayek, Sched. Fl. Stir. Exsicc. iii-iv: 22 (1905).

Sisymbrium nasturtium-aquaticum L., Sp. Pl. ii: 657 (1753).

Nasturtium officinale R. Br. in Ait., Hort. Kew., ed. 2, iv: 110 (1812).—Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 814 (1880).

Prov. *Jaén*: Montes de Cazorla, lake between La Nava de San Pedro and Los Organos, edge of lake, 25 June 1948, *Heywood & Davis 270* (BM).

A low-growing form with poorly differentiated styles, otherwise typical.

SISYMBRIUM CRASSIFOLIUM Cav., Descr. Pl.: 437 (1802).—Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 799 (1880); Suppl. Prodr. Fl. Hisp.: 299 (1893).—O. E. Schulz in Engl., Pflanzenr. IV. 105, Heft 86: 113, fig. 4 E (1924).

Prov. *Jaén*: Sierra de Cazorla in Barranco de Ginés, Sierra de la Cabrilla, *c.* 1,750 m., 16 June 1928, *Lacaita 461* (BM).

Prov. *Albacete*: between Balazote and Robledo, ad margines arvorum, flowers small, canary-yellow, 23 May 1928, *Lacaita 230* (BM)—form intermediate between *S. crassifolium* and *S. laxiflorum*.

The Cazorlan plants are rather undeveloped specimens which suggest to me a lax-flowered depauperate paramorph of *Sisymbrium crassifolium*. There are no ripe siliques and seeds, and the plants are so pressed that the direction of the siliques is doubtful. I can see no reason for calling this gathering *S. laxiflorum* as Pau determined it.

The Albacete plants are in young fruit and difficult to distinguish from *S. crassifolium*; the inflorescence has been too dense for *S. laxiflorum*, and I agree with Pau's determination as *S. crassifolium* 'forma ad *laxiflorum*'.

SISYMBRIUM LAXIFLORUM Boiss., Elench. : 9 (1838); Voy. Bot. Midi Esp. ii: 29, t. 6 (1839).—Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 800 (1880); Suppl. Prodr. Fl. Hisp.: 299 (1893).—O. E. Schulz in Engl., Pflanzenr. IV. 105, Heft 86: 115 (1924).

Sisymbrium crassifolium var. *laxiflorum* (Boiss.) Pau, Not. Bot. v: 10 (1892).

Prov. *Jaén*: Montes de Cazorla, Sierra de Cazorla, near Puerto de Jilillo, locality 6 of 15 June 1927, *Wilmott* (BM); Sierra de Jabalcuz, a little west of Jaén, locality 3 of 11 June 1927, *Wilmott* (BM).

Prov. *Granada*: Sierra Nevada, Dornajo ridge, south-east of Cortijo de la Víbora, small rock mass on east side of col, 10 June 1926, *Wilmott & Lofthouse* (BM).

It is debatable whether *Sisymbrium laxiflorum* is specifically distinct from *S. crassifolium* (cf. Pau and Willkomm (1893)); but the lax-flowered habit, long fruiting raceme, rather longer pedicels, thicker siliques with very pronounced veins on the valves, and more acutely divided leaves serve to distinguish the former species in typical material.

The Cazorlan plants branch from the base (and not from above, as Willkomm (1880) says in his key to separate *S. laxiflorum* from *S. arundanum* Boiss.); and they agree with *S. laxiflorum* in having oblong seeds unlike *S. arundanum* in which the seeds are cylindric (cf. Willkomm (1893)).

S. laxiflorum is quite a rare species and I have given above some unpublished records. The specimens from the Sierra de Jabalcuz have very long and lax inflorescences and, I think, must belong to this species.

SISYMBRELLA ASPERA (L.) Spach, Hist. Nat. Vég., Phan. vi: 426 (1838); O. E. Schulz in Engl., Pflanzenr. IV. 105, Heft 86: 144 (1924); in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, xvii, b: 551 (1936).

Sisymbrium asperum L., Sp. Pl. ii: 659 (1753).

Nasturtium asperum (L.) Boiss., Voy. Bot. Midi Esp. ii: 28 (1839).—Coss., Not. Crit. Esp.: 26 (1849).—Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 814 (1880); Ill. ii: 135, t. 169 B (1892).

Rorippa aspera (L.) Maire in Mém. Soc. Sci. Nat. Maroc xv: 5 (1926); in Jahand. & Maire, Cat. Pl. Maroc ii: 295 (1932).

Subsp. **aspera.**

Rorippa aspera subsp. *eu-aspera* Maire in Jahand. & Maire, Cat. Pl. Maroc ii: 296 (1932), *nom. illegit.*

Prov. ?: Pyrénées Espagnoles, sine loco, *Cambessedes* [*J. Gay*] (1825) (K).

Prov. *Avila*: Avila without precise locality, May 1870, *Maw* (K)—leiocarpic variety with long pedicels.

Prov. *Cáceres*: bords de la rivière près Placencia, 18 May 1863, *Bourgeau 2364* (BM; C)—although Cosson, the author of *Nasturtium boissieri*, determined this as *N. asperum* it is by no means typical, the plants being moderately tuberculate-scabrous, the pedicels 4–7 mm. long, generally shorter than in typical *S. aspera* subsp. *boissieri*, the siliques 3–3·5 cm. long, and some of the fruits smooth; this seems to be a leiocarpic variety.

Prov. *Burgos*: Ayuelos, champs humides vers 650 m., 18 May 1924, *Elías 5152* (BM)—siliques subscabrous or ± glabrescent, otherwise typical; Orón, campos húmedos, May–June 1926, *Losa* (BM)—glabrous and scabrous siliques on the same plant, otherwise typical.

Prov. *Ciudad Real*: in arenosis ad Manzanares, May 1841, *Reuter* (BM; K)—immature specimens, loosely tuberculate, and with young pedicels almost as long as in subsp. *boissieri*.

Prov. *Valencia*: in lacusculis exsiccatis montium de San Marcos, pr. Morella, solo argillaceo-calcareo, ad 1,300 m., June 1935, *Font Quer & Rothmaler* in *Fl. Iber. Select. Cent. III. 224* (K)—excellent example.

PORTUGAL. *Bragança*: caminho de Ricafe, June 1888, *de Mariz 588* (BM)—poor plants but apparently glabrous forms of subsp. *aspera*; the siliques tend to be longer.

Subsp. **boissieri** (Coss.) Heywood, comb. nov.

Sisymbrium asperum sensu Brot., Fl. Lusit. i: 588 (1804).

Nasturtium asperum Boiss., Voy. Bot. Midi Esp. ii: 28 (1839) pro parte, quoad specim. cit.

Nasturtium boissieri Coss., Not. Quelq. Pl.: 26 (1849).—Willk. in Willk. & Lange, Prodr. Fl. Hisp. iii: 814 (1880); Ill. ii: 134, t. 169 A (1892).

Sisymbrella boissieri (Coss.) O. E. Schulz in Engl., Pflanzenr. IV. 105, Heft 86: 144 (1924); in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, xvii, b: 551 (1936).

Rorippa boissieri (Coss.) Maire in Mém. Soc. Sci. Nat. Maroc xv: 5 (1926).

Sisymbrium asperum var. *boissieri* (Coss.) Pau [Carta 3: 1 (1906)] ex Cuatrec. in Trab. Mus. Ci. Nat. Barcel. xii: 295 (1929).

Rorippa aspera subsp. *boissieri* (Coss.) Maire in Jahand. & Maire, Cat. Pl. Maroc ii: 296 (1932).

Prov. *Granada*: Sierra Nevada, Dornajo ridge south-east of Cortijo de la Víbora, heavy soil of barish broad col, also in field there (? fallow), 10 June 1926, *Wilmott & Lofthouse* (BM)—very small alpine forms, rather eaten, *c.* 10 cm. tall, stems scabrous, pedicels 8 cm., flowers *c.* 7 mm. long, fruits scabrous (immature); Sierra Nevada, north-east of Dornajo, 10 June 1926, *Lofthouse* (BM)—fragmentary alpine form; Sierra Nevada, by track from Granada towards Purche, 14 June 1926, *Wilmott & Lofthouse* (BM)—small fragmentary gathering, siliques *c.* 2·5 cm., pedicels 7·5 mm., flowers 7–8 mm.; Sierra Nevada, rocky limestone slopes near Monachil, 14 June 1926, *Wilmott & Lofthouse* (BM)—fragment, flowers *c.* 7 mm., pedicels 8–9 mm., siliques 3+ cm.; Sierra Nevada, Mulhacén y Trevélez, Aug. 1833, *Jimenez* (BM)—± typical; Sierra Nevada, loc. palustribus graminosis in Dehesa de San Gerónimo, 2,100–2,300 m., 14 July 1879, *Huter, Porta & Rigo 178* (BM; C)—leaves with very broad lobes and typical of Willkomm's plate (t. 169 A), stems laxly tuberculate, siliques 4–4·5 cm. long, flowers 6 mm., pedicels 5–7 mm.

Prov. *Albacete*: in pascuis humidis Sierrae de Alcaraz, sol. calcareo, 1,100–1,900 m., 21 June 1891, *Porta & Rigo Iter III. Hisp. 209* (BM).

Prov. *Cádiz*: Grazalema, lieux humides et calcaires, 3 June 1890, *Reverchon* (BM)—flowers *c.* 11 mm., pedicels 10–12 mm. long, siliques very slightly scabrous, immature; lieux humides à la base de la Sierra de las Nieves, 21 June 1849, *Bourgeau 39* (syntype; BM; C; K).

Prov. *Málaga*: in humidis pr. Grazalema, c. Ronda, solo calcareo-argillaceo, ad 900 m., 20 June 1925, *Font Quer* in *Fl. Iber. Select. Cent. III. 225* (K)— magnificent specimen; in humidis montium Granatensium circa Rondam et in Sierra Nevada ad 1,800 m., aest. 1837, *Boissier* (syntype; BM; C; K); Ronda, lieux humides et calcaires, 17 May 1889, *Reverchon 456* (BM)—flowers *c.* 10 mm., pedicels up to 13 mm., siliques immature *c.* 2 cm. long.

Prov. *Jaén*: pâturages humides de la Sierra de Segura, 19 May, *Bourgeau 564* (C); Barranco del Río Segura, lieux frais et calcaires, rare, 1,500 m., June 1906, *Reverchon 1379* (BM).

Portugal. *Lisboa*: pr. Olisponem, 1848, *Welwitsch Fl. Lusit. 429* (BM; C)—leaves with rather narrow lobes, fruits and pedicels ± typical, flowers 8–12 mm. long; in humidiusculis prope Rio do Mouro, rarum, May 1840, *Welwitsch Iter Lusit. 495* (BM; C)—almost completely etuberculate or very slightly tubercled; in monte Serra de Monsanto in vicinitate urbis Olisponis, Apr. 1888, *da Cunha* (BM)—siliques up to 5 cm. long, pedicels 10–13 mm., flowers 7 mm.; Lisboa, in basalticis pr. Vale de Alcántara, May 1878, *Daveau* in *Monteiro Fl. Lusit. Exs. 4718* (BM)—intermediate paramorph, plentifully tuberculate-scabrous, siliques 30–40 mm. densely scabrous-tuberculate, pedicels 8–10 (–12) mm. long; vallée d'Alcántara, champs et collines, Apr.–May 1879, *Daveau* (C)—slightly tuberculate, pedicels very long or normal, fruits typical; Bellas, près Lisbonne, bords des ruisseaux, May 1891, *Daveau* (BM)— ± glabrous, laxly tuberculate, pedicels 9–10 mm. long, large terminal leaflets; between Monte Estoril and Cintra, 17 Apr. 1924, *Leigh Heard* (BM)—flowers 8–10 mm., pedicels 8–12 mm., siliques 3+ cm. long.

Subsp. **pseudoboissieri** (Degen) Heywood, comb. et stat. nov.

Sisymbrium pseudo-boissieri Degen apud Hervier in Bull. Acad. Internat. Géogr. Bot. xv: 170 (1905); op. cit. xvi: 223 (1906).

Sisymbrella pseudo-boissieri (Degen) O. E. Schulz in Engl., Pflanzenr. IV. 105, Heft 86: 144 (1924); in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, xvii, b: 551 (1936).

Rorippa pseudo-boissieri (Degen) Maire in Mém. Soc. Sci. Nat. Maroc xv: 5 (1926).

Prov. *Jaén*: Montes de Cazorla, Le Pozo, lieux humides et calcaires, 1,500 m., June 1905, *Reverchon 1379* (E); Barranco de la Valentina, i.e. Barranco del Guadalentín, lieux frais et humides, sur le calcaire, 1,700 m., June 1904, *Reverchon 1379* (E, isotype); Montes de Cazorla, La Nava de San Pablo, in turf, flowers yellow, 26 June 1948, *Heywood & Davis 312* (BM).

In the Montes de Cazorla *Sisymbrella aspera* (*sensu lato*) is represented by a distinct paramorph which was defined by Degen (apud Hervier, 1905, 1906) as *Sisymbrium pseudo-boissieri*. The plant had previously been distributed as *Nasturtium boissieri*. As its principal diagnostic characters Degen gave the very long funicles of the seeds and the uniseriate arrangement of the seeds in each loculus of the silique. More mature material was awaited to observe if the position of the seeds changed on maturing. My own collections from the Montes de Cazorla bear mature siliques and the seeds are clearly uniseriate in each loculus, and are suspended on long funicles. These are apparently the only valid features to distinguish subsp. *pseudoboissieri* from subspp. *boissieri* and *aspera*. The vegetative differences given by Degen are not reliable, and are discussed below. It should also be noted that subsp. *pseudoboissieri* is polymorphic; some of it could more aptly be termed 'pseudo-aspera'.

Pau (1906) ignored the seed and silique characters of *Sisymbrium pseudo-boissieri* and referred some of Reverchon's collections to *S. boissieri* and some to *S. asperum*.

Variation in *Sisymbrella aspera* (*sensu lato*)

It has been obvious for some time that the differences between *Nasturtium boissieri* and *N. asperum* as given by Willkomm (1892) present a very much over-simplified picture. The vegetative characters, such as leaf-shape, are so variable as to be quite useless in distinguishing between the two taxa, although in 'ideal' cases they hold true. Pau (1906) also comments upon the lack of constancy of such characters.

In studying the variation in *S. aspera* (*sensu lato*) it soon became evident that the important taxonomic features were as follows (I have also given the abbreviations of them employed later):

P = pedicels long, 8–12 mm.
S = siliques long, 25–40 mm.
G = stems ± glabrous
u = seeds 2-seriate in each loculus
F = flowers large, 7–12 mm.
L = siliques smooth

p = pedicels short, 3–8 mm.
s = siliques short, 15–20 mm.
g = stems to greater or lesser degree asperous
U = seeds 1-seriate in each loculus
f = flowers small, 5–7 mm.
l = siliques scabrous, asperous

Thus typical subsp. *aspera* has the formula

psgufl

and typical subsp. *boissieri* the formula

PSGuFL

but in fact, in a series of specimens examined, the following variations of these formulae resulted:

Subsp. *aspera*						Subsp. *boissieri*					
P	s	Gg	u	f	l	Pp	S	gG	u	F	L
P	–	Gg	u	f	l	p	S	gG	u	f	L
p	S	g	u	f	l	P	S	g	u	F	L
p	sS	G	u	f	l	P	S	gG	u	F	L
p	S	g	u	f	lL	P	S	g	u	F	Ll
p	s	g	u	F	l	P	S	G	u	F	l
p	s	g	u	f	lL						

These examples have been taken from Spanish material only (see below). French material of *S. aspera* subsp. *aspera* adheres closely to the formula psgufl. From this I think it may be claimed tentatively that subspp. *boissieri* and *aspera* are distinct separable taxa: although there are transitions in the characters given above, the different combinations of these characters serve to distinguish the two subspecies.

In subsp. *aspera* there are the following minor variations (translated from the above formulae): (1) longipedicellata subglabra; (2) longisiliquosa; (3) sublongisiliquosa glabra; (4) longisiliquosa subleiocarpa; (5) macrantha; (6) subleiocarpa.

And in subsp. *boissieri* there are: (1) subbrevipedicellata subaspera; (2) brevipedicellata subaspera micrantha; (3) aspera and subaspera; (4) aspera subasperocarpa; (5) asperocarpa.

Similarly subsp. *pseudoboissieri* may be represented as typically

PSgUFL

and the variants so far found are

P SgUFl
pPSgUf l

This last formula refers to my own collections; the actual measurements are: stems 15–16 cm. tall, pedicels 3–12 mm., mature siliques 20–28 mm., flowers 5–7 mm. In facies these plants are very similar to Porta and Rigo's gathering from Albacete (No. *209*), itself far from typical of subsp. *boissieri*, and approach the hypothetical 'pseudo-aspera' type (psgUfl).

The uniseriate character in the fruits of subsp. *pseudoboissieri* immediately recalls the *Rorippa nasturtium-aquaticum–R. microphylla* species pair. The two cases are not, for several reasons, comparable. Much more investigation has yet to be made before any general pronouncements on the taxonomic value of uniseriate versus biseriate seeds in Crucifer fruits can be given. Mr. B. L. Burtt has kindly drawn my attention to this phenomenon in species of *Arabis* as illustrated by Holmboe (Stud. Veg. Cyprus: 86 (1914)), and it may occur in many other genera and species. There is no evidence in this particular case in *Sisymbrella* of the presence of polyploidy, and moreover the variation pattern differs from that of the *Rorippa* pair where the distribution of the two species overlaps to a considerable degree as in Britain (cf. Howard & Lyon[1]) or only one species is present as in Denmark (cf. Hylander[2]). Also there is a widely distributed hybrid between the two species.

Many problems, taxonomic, anatomical and cytological, remain to be solved, for example the origin of the uniseriation of the seeds and the long funicles, and the genetic make-up of the taxon. It must be emphasized that this is no more than a preliminary account of the genus *Sisymbrella* in the Iberian Peninsula; much more investigation will have to be made before any firm conclusions can be reached. There remains but to add some observations on the distribution and origin of the various groups.

The various characters used in classifying this group appear in Spain in different combinations, and the most constant of these are length of pedicel and silique, and size of flower. If division is made according to these criteria there is a fairly good geographical pattern of subspecific differentiation. Subsp. *boissieri* is mainly confined to Betica with an outlying area in Portugal where forms intermediate in asperity occur (there is a distinctly scabrous form near Lisbon). Subsp. *aspera* is highly polymorphic in the Spanish part of its range (most of Spain excluding Betica), and only rarely are typical paramorphs found with the characteristic facies of those that grow in the main part of the area in south and west France. In fact central and northern Spain appears to be the transitional zone between the pure populations of subspp. *boissieri* and *aspera*, although the paramorphs growing there are here, for convenience, included under subsp. *aspera*.

The third subspecies, subsp. *pseudoboissieri*, is endemic to the Montes de Cazorla in the Province of Jaén (Betica). It is possibly a polyploid of hybrid origin and contains 'pseudo-boissieri' and 'pseudo-aspera' variants.

According to Maire (1932) *Rorippa aspera* subsp. *boissieri* extends into Morocco where two other subspecies are represented—*munbyana* (Boiss. & Reut.) Maire and *hayanica* (Maire) Maire, the former being found also in Algeria.

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[1] H. W. Howard & A. G. Lyon, *The Identification and Distribution of the British Watercress Species*, Watsonia i: 228–233 (1950).

[2] N. Hylander, *Rorippa microphylla i Sverige och Danmark*, Bot. Notis. 1950: 1–13 (1950).

GERANIACEAE

Geranium cataractarum Coss., Not. Quelq. Pl.: 99 (1851).—Lange in Willk. & Lange, Prodr. Fl. Hisp. iii: 531 (1878).—R. Knuth in Engl., Pflanzenr. IV. 129: 90 (1912).

Geranium cataractarum forma *cazorlanum* Pau ex Lacaita in Bull. Soc. Bot. Genève, Sér. 2, xxi: 133 (1929), *nom. nud.*

Prov. *Jaén*: Montes de Cazorla, between La Yedra and Cerro Cabañas, Sierra de la Cabrilla, limestone rocks, flowers pink, 1 July 1948, *Heywood & Davis 482* (BM); Montes de Cazorla, near Casa Forestal of La Nava de San Pedro, limestone rocks, 26 June 1948, *Heywood & Davis 229* (BM); Sierra de Cazorla, above Cazorla towards Fuente de Rechita, locality 3 of 14 June 1927, *Wilmott* (BM); *ibid.*, locality 3b of 14 June 1927, *Wilmott* (BM); Sierra de Cazorla, rocks near Fuente de Rechita, scarce, flowers strong reddish-purple, scent of *G. robertianum*, 14 June 1927, *Lacaita 290* (BM)—with note 'Pau calls this var. nova . . . I can't think why'; Sierra de Cazorla, al Punta del Aire, shady clefts in rocks, 15 June 1928, *Lacaita 448* (BM); peñascos calizos de Los Organos, 1,150 m., *Cuatrecasas*[1]; peñascos de los Aguilones de Fuente Umbría, 1,300 m., *Cuatrecasas*[1].

Geranium cataractarum is a rare species known from only a few localities in south Spain and North Africa. It is considerably influenced by the ecological conditions of its habitat and consequently shows much variation in habit and structure.

Lacaita collected the species in 1927 at the *locus classicus*, the cave of Chorro del Mundo in the Sierra de Alcaraz where, he said (in herb.), 'the habit, owing to the exceptional situation, is rather different from that of the Sierras de Cazorla where in 1928 we [Lacaita and Cuatrecasas] found it plentifully in the inner ranges'. The Chorro del Mundo is the cave where the Río Mundo bursts forth in a cascade, the habitat being shady and wet with a permanently humid atmosphere.

Leaf-shape is apparently much affected by the humidity of the habitat. Font Quer (in Cavanillesia iv: 89 (1931)) points out that in subsp. *pitardii* Maire, described from the Middle Atlas, the leaf-characters given to distinguish it (lower leaves deeply divided with the lobes pinnatifid or pinnatisect, and the middle segment of the upper leaves petiolate) are merely extreme forms which are linked by transitional types with Spanish material.

Some of the specimens collected by Lacaita in the Sierra de Cazorla were sent to Pau who named them as a distinct Cazorlan form but without stating any reasons. As Lacaita has said—and I agree—there seems to be no reason why the Cazorlan plants should be differentiated from the typical.

It is true that the Cazorlan material is far from uniform: *Heywood & Davis 482* is doubtfully perennial whereas *Heywood & Davis 229* is definitely so. The size of the plants and leaves varies—Wilmott's specimens are smaller than the others cited—and the calyx shows different degrees of pilose indumentum.

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[1] *Fide* Melchior & Cuatrecasas in Cavanillesia vii: 137 (1935).

GERANIUM LUCIDUM L., Sp. Pl. ii: 682 (1753).—Lange in Willk. & Lange, Prodr. Fl. Hisp. iii: 530 (1878).—R. Knuth in Engl., Pflanzenr. IV. 129: 63 (1912).

Prov. *Jaén*: Montes de Cazorla, between San Pablo and Los Organos, in *Pinetum*, loose screes, in fruit, 27 June 1948, *Heywood & Davis 274* (BM); Montes de Cazorla, near Casa Forestal of La Nava de San Pedro, screes of limestone, in fruit, 25 June 1948, *Heywood & Davis 127* (BM).

The plants collected between San Pablo and Los Organos are notable in having the leaves densely covered with a minute farina (of sessile glands?). Otherwise they are more or less typical of the species.

GERANIUM ROTUNDIFOLIUM L., Sp. Pl. ii: 683 (1753).—Lange in Willk. & Lange, Prodr. Fl. Hisp. iii: 529 (1878).—R. Knuth in Engl., Pflanzenr. IV. 129: 55 (1912).

Prov. *Jaén*: Montes de Cazorla, between San Pablo and Los Organos, leaves of a velvety texture, 27 June 1948, *Heywood & Davis 275* (BM).

This is a diminutive form of *Geranium rotundifolium*, about 15 cm. tall, very densely branched, and with leaves smaller than usual. Such a variant has been recorded before: *G. rotundifolium* var. *caespitulosum* Loj. Poj. in Malpighia xx: 195 (1906)—'Omnibus partibus diminutum, dense ramulosum, pumilum'—but Knuth remarks that he thinks it scarcely distinguishable from the type. Knuth's description of this species is scarcely wide enough to include much of the French and Spanish material.

Geranium cazorlense Heywood, sp. nov.

Affinis *G. cinereo* Cav. in Sect. *Subacaulibus* sed statura minori, habitu magis caespitoso, partitionibus foliorum inter se approximatis crenatim divisis crenis obovatis obtusissimis, floribus minoribus, sepalis minoribus oblongis acutis nec mucronatis vel raro breviter mucronatis, petalis angustioribus albis violaceo-venosis, distinguenda.

Herba perennis ± acaulis, dense caespitosa, alpina, 5–8 cm. alta, totum molliter adpresse pubescens vel pilosa, cinerascens; rhizoma crassum usque 1 cm. diametro, superne dichotomum, reliquiis stipularum dense squamigerum, fuscum. *Folia* omnia radicalia, rosulata, rotundata vel etiam orbicularia, 1·5–2·5 cm. diametro, longe petiolata (petiolo 3–8 cm. longo), 5–6-divisa sed lobis inter se approximatis et tricrenatim divisis crenis obovatis obtusissimis rotundatis, folia solum profunde crenata simulantia; stipulae ovato-lanceolatae, acutae vel acuminatae, rubro-fuscae, pubescentes. *Pedunculi* radicales e caudice 2–4 cm. alti, biflori; pedicelli 2–4 cm. longi; bracteae lanceolatae, acutae. *Sepala* 5–7 mm. longa, 2–2·5 mm. lata, oblonga, acuta vel acuminata vel breviter mucronata, dense et adpresse pilosa aut pilis patentibus hirsuta, eglandulosa. *Petala* calycem duplo subduplove superantia, obovata, apice emarginata, alba, violaceo-venosa. *Filamenta* in sicco albida, infra medium dilatata ciliata. *Fructus* nondum maturus 2 cm. longus, carpidiis pilis longis hyalinis strigosis, rostro breviter atque dense piloso; semina immatura laevia. Floret Jul.

Prov. *Jaén*: Montes de Cazorla, Sierra de Pozo Alcón, Pico de Cabañas, near and under limestone arch, in limestone crevices, rocks, flowers white veined with violet, 1 July 1948, *Heywood & Davis 447* (BM, holotype; C; E; K).

Geranium cazorlense is most closely related to *G. cinereum* Cav., which in Spain is found in the Pyrenees. It is a more caespitose lower-growing plant than the Pyrenean, and the lobes into which the leaf is divided are scarcely separated from one another and are in turn very obtusely crenate so as to simulate a deeply crenate, not palmate, leaf. Occasionally paramorphs of *G. cinereum* approach it in leaf-shape but the crenations are never so obtuse, and the other differences given in the diagnosis hold true. The flower-colour too is quite distinct. *G. cazorlense* is very similar in facies to some saxatile species of *Erodium*.

ERODIUM CICUTARIUM (L.) L'Hérit. in Ait., Hort. Kew. ii: 414 (1789).—Lange in Willk. & Lange, Prodr. Fl. Hisp. iii: 536 (1878).—R. Knuth in Engl., Pflanzenr. IV. 129: 274 (1912).

Geranium cicutarium L., Sp. Pl. ii: 680 (1753).

Prov. *Jaén*: Montes de Cazorla, Sierra de Pozo Alcón, near Pico de Cabañas, *c.* 1,500 m., annual, in fruit, 1 July 1948, *Heywood & Davis 503* (BM).

This collection is in fruit but appears to be the common form: it is not any of the varieties listed by Knuth.

ERODIUM DAUCOIDES Boiss., Elench.: 28 (1838); Voy. Bot. Midi Esp. ii: 121, t. 37 fig. B (1839).—Lange in Willk. & Lange, Prodr. Fl. Hisp. iii: 534 (1878).—Willk., Suppl. Prodr. Fl. Hisp.: 265 (1893).—R. Knuth in Engl., Pflanzenr. IV. 129: 287, fig. 36 (1912) excl. specim. Reverch.

Prov. *Jaén*: Montes de Cazorla, Sierra de la Cabrilla, peak of Las Empanadas, limestone rocks, screes, slopes, flowers pale-pink with purple-crimson markings on upper petals, 28 June 1948, *Heywood & Davis 301* (BM); Sierra de Cazorla, ridge of Las Empanadas in Sierra de la Cabrilla, *c.* 2,000 m., 16 June 1928, *Lacaita 467* (BM).

Prov. *Granada*: Sierra Nevada, vis-à-vis de San Gerónimo, *Boissier* (Herb. Boiss., type); Sierra Nevada, Dornajo, 26 July 1864, *del Campo* (BM); Sierra Nevada, région alpine à Canadillas, 8 July 1852, *del Campo 23* (BM); Sierra Nevada, barranco de Trevélez, 2,100 m., Sept. 1844, *Willkomm* (BM); Sierra Nevada, au Monte Verde au-dessus du Cerro Trevenque, 1851, *Bourgeau 1102* (C).

There is considerable confusion over this species: Lange states 'Species indumento glanduloso et stipulis niveis optime recognoscenda!' Knuth keys *Erodium daucoides* under 'Folia non glandulosa' and describes the stipules as 'fuscae'. As there are

	Author		
Character	*Lange*	*Boissier*	*Knuth*
Indumentum	glandular	—	eglandular
Stipules	white	—	fuscous
Pinnules (2nd order)	oval-obovate, obtusish	very short, acutish	linear-lanceolate, acutish
Bracts	ovate	ovate	linear or linear-lanceolate
Fruiting pedicels	refracted	twice refracted	refracted

other disagreements between Knuth and Lange a table of comparison is given above together with points from Boissier's original description where pertinent.

The species of Lange and Knuth are obviously fundamentally different. It is unfortunate that Boissier did not mention presence or absence of glandular indumentum, or the colour of the stipules, in either his original description or in the *Voyage*.

We will consider Knuth's citations for *E. daucoides*:

1.[1] Sierra Nevada, Trevenque, *Boissier*. Dr. Baehni has very kindly sent me on loan two type specimens from the Boissier Herbarium, 'Sierra Nevada, vis-à-vis de San Gerónimo'.[2] This locality is given by Boissier (1839) for *E. daucoides*, and the specimens are more or less identical with other material I have quoted above from the Cerro Trevenque.

1.[1] Canadillas, *del Campo 23*: this is a glandular paramorph and fits both Boissier's and Lange's descriptions in most respects, and is more or less identical with Boissier's San Gerónimo types.

3. Dornajo, *Huter, Porta & Rigo 450*: this plant is difficult to place. It is not cited by Lange nor in Willkomm's *Supplement*. Apparently it is an eglandular paramorph of *E. daucoides*. Knuth also cites this gathering for *E. cheilanthifolium* (= *E. trichomanifolium* subsp. *cheilanthifolium*)!
4. Javalambre, *Reverchon 805*: this is *E. trichomanifolium* var. *cavanillesii*, and the locality is one of three to which it is endemic! (see below).
5. Yelmo de Segura (*fide* Brumhard): I have seen Porta and Rigo's collection from this locality (No. *478*) and it must be regarded as atypical *E. daucoides*.

Knuth's *E. daucoides* is thus a somewhat mixed concept containing glandular and eglandular paramorphs and another species. It is most unfortunate that such confusion should be found in a monograph; there is no discussion of the species whatsoever. I think Lange's species may safely be equated with Boissier's original.

We must examine the anomalous material in *E. daucoides* before deciding how to deal with the species:

Prov. *Jaén*: ad rupes in Monte Yelmo de Segura, sol. calcar., 1,500–2,000 m., July 1890, *Porta & Rigo Iter II. Hisp. 478*.

Willkomm records a gathering of Porta and Rigo from this locality for *E. daucoides*. The plants are by no means typical—they are much less caespitose and loosergrowing with taller stems than usual, resembling *E. carvifolium* Boiss. & Reut. in habit. The indumentum is quite dense and slightly glandular. As the differences are mainly in habit there seems no reason for separating this paramorph taxonomically from *E. daucoides*. Certainly more material and field observations of this variant are to be desired.

Prov. *Granada*: Sierra Nevada, in rupestribus glareosis parte calcar. mte Dornajo, 2,100–2,300 m., 11 July 1879, *Huter, Porta & Rigo 450*.

As mentioned above, this collection is cited by Knuth under *E. daucoides*. The leaf-indumentum is essentially non-glandular with only an occasional gland-tipped trichome. The leaves are bipinnatisect with the rhachis more or less entire, not dentate, thus differentiating the plant from *E. cheilanthifolium* (= *E. trichomanifolium* subsp. *cheilanthifolium*), under which Knuth also cited this gathering. It does not even resemble *E. trichomanifolium* in facies. Variation is shown by the second-order pinnules: they may be ovate or obovate, acutish or obtusish, or oblong-obovate obtusish. The stipules are whitish, withering light-brown. The fovea of the fruit has a slight concentric fold, but I am doubtful about the value of this as a taxonomic character: it is often difficult to decide whether or not there are concentric folds (intergradations are not uncommon, in some species at least). Finally the bracts are ovate or ovate-lanceolate. There is no other species this can be—a possible alternative might have been *E. carvifolium*, which is in the same leaf-type group, but the gathering in question is far removed from that species. In all fairness it must be admitted that this collection from the Cerro Dornajo lends some support to Knuth's idea of *E. daucoides*, but only in that the leaf-indumentum is almost eglandular.

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[1] Localities also given by Lange.

[2] In these specimens the leaves have a glandular indumentum, the stipules are white, the bracts ovate-acutish, the second-order pinnules short oblong-obtusish or ovate-acutish, entire or subdentate. There are no fruits.

In summary, *E. daucoides* is typically a species with a glandular indumentum but contains eglandular variants. These latter do not possess all the characters of Knuth's *E. daucoides* which is an artificial group containing more than one species.

Var. **latilobum** Heywood, var. nov.

A typo indumento eglanduloso densiori griseo-tomentoso, stipulis albido-fuscis brevioribus, foliis minus dissectis pinnis longioribus latioribusque planis, pinnulis latioribus, distinguitur. Ulterius observanda!

Prov. *Jaén*: Sierra de Cazorla, rocks near Puerto de la Calabaza, 15 June 1927, *Lacaita 327* (BM, holotype)—'*Erodium astragaloides* var. . . . foliis magis dissectis quam in planta e Sierra Nevada'; above Cazorla, Puerto de la Calabaza, locality 7a of 15 June 1927, *Wilmott* (BM); Montes de Cazorla, Sierra de Pozo Alcón, below summit of Pico de Cabañas, rocks, screes, flowers pale-lilac, upper petals veined and blotched carmine, leaves grey, 1 July 1948, *Heywood & Davis 454* (BM; C; E; K).

This curious new variety has so far only been found on the Cerro Cabañas and near the Puerto de la Calabaza in the Montes de Cazorla. The specimens are handsome robust plants with broad leaflets in one plane, flat and not crowded as is typical of *E. daucoides*, and the pinnules are notably broader than in that species. Lacaita was so impressed by these leaf-characters that he regarded his collection from the Puerto de la Calabaza as a new variety of *E. astragaloides* Boiss. & Reut. with more dissected leaves and intermediate to some other unnamed species. *E. astragaloides* is described by Lange (in Willk. & Lange, Prodr. Fl. Hisp. iii: 535 (1878)) as having the leaf-segments entire or 3–5-lobed but I have not seen any specimens of the latter type. I feel that the variety is nearer to *E. daucoides* than *E. astragaloides* but I should like to make further field observations before deciding definitely. The new variety approaches the eglandular variant of *E. daucoides* from the Cerro Dornajo mentioned above (*Huter, Porta & Rigo 450*) but it is still distinguished by its leaf-division.

Erodium cazorlanum Heywood, sp. nov.

Ex affinitate *E. daucoidis* Boiss. in Sect. *Romanis*, a qua habitu robustiori, foliorum pinnis magis distantibus paullum latioribus, scapis 3–9 (nec 2–6) -floris 14–18 (nec 5–10) cm. longis, etiam indumento eglanduloso, distinguitur; ab *E. carvifolio* Boiss. & Reut. foliis minus dissectis, pinnulis non lineari-lanceolatis acutis, id est foliis non tripinnatisectis sed interdum vix bipinnatisectis pinnis dentatis, foliis etiam minoribus 3–5 cm. longis, 1–1·25 cm. latis (nec 5–16 cm. longis, 2 cm. latis), indumento densiori cum matrice basali farinae, stipulis minoribus plerumque 5–6 (nec saepe 8–10) cm. longis, bracteis non demum glabrescentibus, pedicellis longius pubescenti-glandulosis, sepalis densius pubescentibus paullum longioribus latioribusque, sat divergit.

Herba perennis, acaulis, 15–18 cm. alta, laxe caespitosa, rhizomate crasso lignoso atrofusco 1·25 cm. diametro squamigero superne diviso. *Folia* fere omnia basalia, indumento utrinque dense griseo-tomentoso, saepius longe petiolata petiolo lamina longiori vel breviori vel eae subaequali, 3–5 cm. longa, 1–1·25 cm. lata, bipinnatisecta, pinnis ± distantibus pinnatifidis vel dentatis, rhachide integra; stipulae 5–8 mm. longae, ovatae vel ovato-lanceolatae, acutae. *Pedunculi* pilis longis flexuosis et pilis glanduliferis (praecipue in parte superiori) intermixtis, 3–9-flori, 14–18 cm. alti, bracteis 6–9 involucriformibus lanceolatis acutis subtomentosis albis vena centrali viridi, membranaceis non demum glabrescentibus; pedicelli calyce 2–4-plo longiores, dense glanduloso-pubescentes, interdum ± refracti. *Sepala* oblonga, acuta, mucronata, dense glandulosa, 8–10 mm. longa, 2·5–3 mm. lata. *Corolla* adhuc ignota. *Fructus* 4 cm. longus, rostro breviter piloso, fovea plica concentrica praedita.

Prov. *Jaén*: Montes de Cazorla, Sierra de Cazorla, near and on summit of Cuerda de las Moras, limestone rocks and screes in full sun, in fruit, seeds collected, 4 July 1948, *Heywood & Davis* 545 (BM, holotype; K).

In Knuth's key to the Section *Romana* this species comes out as *Erodium romanum* (Burm. f.) L'Hérit. from which it is vastly different, or, if the character of the fovea is ignored, as *E. carvifolium*. It is certainly not this but is more closely allied to *E. daucoides*. *E. cazorlanum* is at once distinguished from *E. daucoides* by its very long many-flowered scapes.

ERODIUM TRICHOMANIFOLIUM L'Hérit. ex DC., Prodr. i: 645 (1824) ('*trichomanefolium*').

Recently Rivas Goday (in An. Jard. Bot. Madrid vi, 2: 397–407 (1946)) has made a study of the *trichomanifolium-cheilanthifolium* group of *Erodium*. He regards the Spanish representatives of this complex as a distinct species (*E. cheilanthifolium*) but admits that they could be regarded as vicariant offspring of *E. trichomanifolium* of the Near East. As the main difference he gives maculation of the upper petals in the Spanish plants.

The history of the taxonomy of this group is well known. In 1838 Boissier in his *Elenchus* described a Spanish plant as a new species, *E. cheilanthifolium*; the following year in his *Voyage Botanique* (ii: 120) he referred it to *E. trichomanifolium*. Later (Fl. Or. i: 887 (1867)) he reaffirmed the specific distinctness of the Spanish plant

(*E. cheilanthifolium*) from *E. trichomanifolium*, differentiating it by 'pube cinereâ non glandulosâ, foliis ambitu ovato-oblongis, petalis superioribus maculatis'. Lange (1878), Knuth (1912) and Maire (1932) retained *E. cheilanthifolium* as a separate species. But in 1922 Pau, noting that the nature of the indumentum of the Spanish plants is very inconstant ('viendo ejemplares virescentes y glandulosos, no pubescentes, sino pelosos o vellosos'), subordinated *E. cheilanthifolium* as a variety of *E. trichomanifolium*. Cuatrecasas (in Trab. Mus. Ci. Nat. Barcel. xii: 349 (1929)) united the two without distinction after studying the populations of the Macizo de Mágina and material collected by Gros in the mountains of Málaga.

The Spanish *E. cheilanthifolium* is divided by Rivas Goday into two subspecies—the typical one, and subsp. *celtibericum* (Pau) Riv. God., i.e. Cavanilles's 'geranio' from Peñagolosa. The only valid taxonomic differences he can find between the two subspecies are that the leaves and stems in subsp. *celtibericum* possess an indumentum containing erect trichomes with terminal glands, whereas typical *E. cheilanthifolium* is destitute of them. But as already mentioned there are numerous intermediates in regard to indumentum in the populations of *E. cheilanthifolium*. Further discussion of this problem is given below.

Considering the nature and inconstancy of the characters differentiating the east and west Mediterranean taxa, and the only partial distinction between the north and south Spanish paramorphs, I feel that a more satisfying treatment is to regard the major groups as subspecies and the minor Spanish ones as geographical varieties.

Maire records typical *E. cheilanthifolium* (var. *genuinum*) from Morocco. Also from North Africa he lists *E. cheilanthifolium* var. *font-queri* Maire, endemic to Morocco, and *E. cheilanthifolium* subsp. *antariense* (Rouy) Maire, from Algeria and Morocco. As I have not seen material of these two taxa they are not treated in this paper, but from their descriptions it seems that their status may well be maintained.

I here give a key to *E. trichomanifolium* (*sensu lato*), containing differential characters of the component groups which I have studied.

Petala regularia, superiora immaculata, calycem saepe vix excedentia; sepala c. 9 mm. longa; indumentum densum, glandulosum (Oriens) . . . . subsp. *trichomanifolium*

Petala irregularia, superiora maculata majora, calyce duplo longiora; sepala c. 6 mm. longa; indumentum sparsum vel densum, glandulosum vel ± eglandulosum (Hispania, Africa sept.) . . . . subsp. *cheilanthifolium*

  Folia caulesque pilis glandulosis nullis vel perpaucis praedita (Baetica) . . var. *cheilanthifolium*

  Folia caulesque indumento pilorum apice glandulo terminatorum praedita (Valentia, Aragonia) . . . . var. *cavanillesii*

Subsp. **cheilanthifolium** (Boiss.) Heywood, comb. nov.

Erodium cheilanthifolium Boiss., Elench.: 27 (1838).—Lange in Willk. & Lange, Prodr. Fl. Hisp. iii: 533 (1878).—R. Knuth in Engl., Pflanzenr. IV. 129: 270, fig. 35 (1912).

Erodium trichomanifolium sensu Boiss., Voy. Bot. Midi Esp. ii: 120, t. 37 fig. A (1839).

Erodium trichomanifolium var. *cheilanthifolium* (Boiss.) Pau in Mem. Mus. Ci. Nat. Barcel., Sér. Bot. i, 1: 31 (1922).

Erodium cheilanthifolium subsp. *eu-cheilanthifolium* Maire in Jahand. & Maire, Cat. Pl. Maroc ii: 442 (1932), *nom. illegit.*

Var. **cheilanthifolium** (Boiss.) Pau, loc. cit. (1922).

Erodium cheilanthifolium var. *genuinum* Maire, loc. cit. (1932), *nom. illegit.*

Prov. *Jaén*: Montes de Cazorla, Pico de la Garganta (Cabeza del Tejo) above La Nava de San Pedro, below peak in north-facing rocks with *Sedum* sp. (*Heywood & Davis 107*), flowers pale-pink, dark-veined with the two upper petals blotched, 25 June 1948, *Heywood & Davis 106* (BM); Sierra de la Cabrilla, cliffs by Nava del Asno, *c.* 1,750 m., 16 June 1928, *Lacaita 470* (BM); Sierra de la Cabrilla, cliffs of Riscos de Carilarga, *c.* 1,700 m., 16 June 1928, *Lacaita 475* (BM).

The specimens from the Pico de la Garganta are of exceptionally well-developed plants with trunks up to 1·75 cm. in thickness. The leaves are non-glandular but there is a sparse farina present in the ground mass, and occasional trichomes of the indumentum do bear glands. The peduncles become glandular towards the apex and the pedicels are markedly so.

Var. **cavanillesii** (Willk.) Heywood, comb. nov.

Erodium supracanum sensu Lange in Willk. & Lange, Prodr. Fl. Hisp. iii: 533 (1878) pro parte, quoad pl. e loco Peñagalosa; non L'Hérit.

Erodium cheilanthifolium sensu Loscos, Trat. Pl. Arag., Supl. 8: 97 (1886).

Erodium celtibericum Pau, Not. Bot. v: 19 (1892).

Erodium cheilanthifolium var. *cavanillesii* Willk., Suppl. Prodr. Fl. Hisp.: 265 (1893).

Erodium cheilanthifolium var. *valentinum* Brumhard, Monogr. Übers. Gatt. Erodium: 52 (1905) pro parte, excl. syn. Boiss. & Reut.—R. Knuth in Engl., Pflanzenr. IV. 129: 271 (1912) pro parte, excl. syn. *E. valentino* et *E. petraeo* var. *valentino*.

Erodium cheilanthifolium subsp. *celtibericum* (Pau) Riv. God. in An. Jard. Bot. Madrid vi, 2: 406 (1946).

In 1878 Lange (loc. cit.) published *E. petraeum* var. *valentinum* with the definition 'breviter et patule pilosum, canescens, floribus minoribus, petalis albis, roseo-venosis'. He gave the following citations:

Valentia: Sierra de Castalla pr. Alicante (*Leresche*); S. Mariola (*Boiss. & Reut.*).
Murcia: Sierra de Espuña (*Guir.*); S. de Huescar (*Bourg.*).

Later Willkomm (1893) added: Bernia ad la Cueva (*Lacaita*); Segarria (*Rouy*).

Lange was not sure of the position of his plant and noted 'Formam . . . vix nisi *E. petraei* varietatem esse censeo, quod ulterius in vivo observandum'. But before continuing with the history of this plant we must turn to Cavanilles's 'geranio' from Peñagolosa.

Cavanilles in his celebrated *Observaciones*[1] described a 'geranio' from the slopes of the peak of Peñagolosa, without naming it. Loscos gave the same plant from the Sierra del Pobo as *E. cheilanthifolium* and Lange apparently due to some error included Cavanilles's plant under *E. supracanum* L'Hérit. Pau, after visiting Peñagolosa, distinguished the 'geranio' discovered by Cavanilles as *E. celtibericum*.

In the following year Willkomm described *E. cheilanthifolium* var. *cavanillesii* based on *E. celtibericum* Pau and gave the following description: 'Differt a planta granatensi foliis multo minoribus breviter petiolatis. Format caespites latos rupibus adpressos, foliis dense tectos.' The specimens he cited were:

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[1] *Observaciones sobre la Historia Natural . . . del Reyno de Valencia* i: 87 (1795).

Valentia: Pico de Peñagolosa (*Cav.*, *Pau*, *Reverch.*[1]).

Aragon. austr.: Sierra de Javalambre (*Pau*, *Reverch.*), Sierra del Pobo pr. Las Parras (*Badal*).

As was mentioned above, Rivas Goday treats the 'geranio' from Peñagolosa as a subspecies of *E. cheilanthifolium*, but before discussing its status we must turn to Knuth's treatment.

Knuth (1912) followed Brumhard[2] in joining *E. petraeum* var. *valentinum* to *E. cheilanthifolium*, and linked with it *E. celtibericum* (*E. cheilanthifolium* var. *cavanillesii*). He described the resultant composite taxon, *E. cheilanthifolium* var. *valentinum*, as 'humillimum, dense caespitosum, caespitibus foliorum 1–2 cm altis. Folia densissime incano-tomentosa. Rhizoma valde incrassatum.' Knuth cited: 'Prov. Alicante, auf dem Mariola (Hegelmaier a. 1878!)' but did not mention any of the specimens (syntypes) cited by Lange for *E. petraeum* var. *valentinum*. He then went on to say 'Die Varietät stellt nur eine gedrungene, hochalpine Form vor', and quoted the specimens of *E. cheilanthifolium* var. *cavanillesii* cited by Willkomm.

E. petraeum is a species with immaculate corollas, that is, the upper petals are not blotched with purple or carmine, and var. *valentinum* Lange agrees in this character, thus separating it from the 'geranio' of Peñagolosa. Lacaita notes of his specimens collected in La Segarria 'petala pallide rosea, nec alba et venis saturate roseis, vive purpureis striatis: forma minus hirsuta quam planta Lereschiana ex Sierra de Castalla; vidi etiam in M. Bernia loco dicto Cueva de Bernia'. An authentic specimen of var. *valentinum* in the University Herbarium, Cambridge (Sierra de Huéscar, *Bourgeau*), does in fact appear to be related to *E. petraeum*. I cannot see any reason for attaching it to *E. trichomanifolium* subsp. *cheilanthifolium*: it is certainly not var. *cavanillesii*. Indeed it is difficult to see how Brumhard's and Knuth's confusion can have arisen, for from descriptions alone it is evident that the two varieties *E. trichomanifolium* var. *cavanillesii* and *E. petraeum* var. *valentinum* belong to different species.

Brumhard's and Knuth's *E. cheilanthifolium* var. *valentinum* is therefore a mixture containing *E. petraeum* var. *valentinum* and *E. trichomanifolium* var. *cavanillesii*.

The vegetative and habit differences given by Willkomm and others for var. *cavanillesii* are of little value, although it is true that occasionally it grows at higher altitudes than var. *cheilanthifolium* and assumes an 'alpine form' appearance. Rivas Goday's differentiation, however, does appear to be valid; he says 'La planta de Cavanilles difiere de la de Bo[i]ssier, esencialmente en un decisivo carácter específico, muy en boga en la actualidad y utilizado por los sistemáticos, por la abundancia de tricomas erectos con glandulita terminal, que ocasiona se adhieran con facilidad arenilla y restos orgánicos; cosa que no le ocurre al *cheilanthifolium* typico'. There are also slight differences in the shape of the bracts and sepals of var. *cavanillesii* but they are not of much account.

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[1] According to the specimens of this in the British Museum Herbarium it was labelled as *E. daucoides* Boiss., but it is clearly not this.

[2] Brumhard's monograph (*Monographische Übersicht der Gattung Erodium*, Breslau, 1905) was an inaugural dissertation for the degree of Ph.D. It is a short, and apparently uncritical, synopsis of the genus, rather than a monograph; no specimens are cited, nor is there any considerable discussion of the species. Knuth (1912) adopted many of Brumhard's conclusions, but again without justifying them.

E. trichomanifolium var. *cheilanthifolium* is widely distributed in the mountains which make up the Betic system. It is found mainly in the following ranges: Sierra Nevada (Dornajo, Peñones de San Francisco, Veleta, Cerro del Rayo, Minas de Beiras, Dientes de la Vieja, etc.), Sierra Prieta, S. de las Cabras, S. de Lujar, Antequera, S. de Jarana, S. de las Nieves, S. de Alfacar, S. de Yunquera, S. de María, S. de Baza, S. Tejeda, Serranía de Ronda, Macizo de Mágina, Montes de Cazorla. Rivas Goday says it is replaced by *E. daucoides* in Alcaraz and Riopar: this is not strictly true as *E. daucoides* coexists with *E. trichomanifolium* subsp. *cheilanthifolium* in some localities such as the Sierra de la Cabrilla and Cerro Dornajo.

Rivas Goday suggests that *E. trichomanifolium* originated in Asia Minor and Syria, and that the Spanish plants could be regarded as vicariant races of it. The 'pure' area of the Spanish subspecies would therefore be the Sierra Nevada where the plants are more or less eglandular. As the subspecies extended its range further north in Spain it became re-invested with glands to varying degrees, culminating in the prominently glandular var. *cavanillesii*. Although there is not sufficient material to confirm this, it looks as though there is an interrupted cline in gland-development from south to north—interrupted because of the discontinuity in range between the two varieties.

E. trichomanifolium var. *cavanillesii* is restricted to the Pico de Peñagolosa (prov. Castellón de la Plana), Macizo de Jabalambre (prov. Teruel), Sierra del Pobo, and according to Vicioso[1] the Sierra del Costanazo, Pico Frentes (prov. Soria). And finally it should be added that var. *cavanillesii* differs from the oriental subsp. *trichomanifolium* mainly in the one character of maculate upper petals.

APPENDIX

CARLOS PAU'S *CARTAS Á UN BOTÁNICO*

During the years 1904 to 1907 the venerated Spanish botanist Carlos Pau of Segorbe compiled a series of annotations on the French botanist-collector Reverchon's exsiccata from the provinces of Jaén and Granada. He had these printed in four parts, in the form of letters, each commencing 'Sr. D. . . .' [completed by hand], hence the title *Carta á un botánico*. The bibliographical details are:

[1.] pp. 1–8. Zaragoza: Imp. y Fotog. Abadía y Capapé. 1904. Written 'Segorbe 7 de Abril de 1904'.
2. pp. 1–11. [*Idem.*] 1905. Written 'Segorbe 30 de Enero de 1905'.
3. pp. 1–8. Zaragoza: M. Escar, Tip. 1906. Written 'Segorbe 17 de Abril 1906'.
4. pp. 1–10. Zaragoza: M. Escar, Tip., San Miguel, 12. 1907. Written 'Segorbe 3 de Marzo de 1907'.

These *Cartas* were apparently printed for private circulation to Pau's botanical friends in Spain and (from evidence in the letters) to some in Italy. The nature of the contents is such that one would scarcely expect them to have been sent to any French botanists! Dr. Baehni informs me that there is a set of the *Cartas* in the Boissier Library, Geneva. In Britain the only copy is that of C. C. Lacaita, deposited with his herbarium in the British Museum (Natural History).

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[1] C. Vicioso Martínez, *Materiales para el estudio de la flora soriana*, An. Jard. Bot. Madrid ii: 216 (1942).

In view of the fact that these *Cartas* were not put on sale nor distributed to botanical institutions (in fact they were not, strictly speaking, published at all) they should be considered as not having been 'effectively published' within the intent of the International Code of Botanical Nomenclature (Art. 39). Mr. J. E. Dandy of the British Museum agrees with me in this interpretation.

In content the *Cartas* were exceedingly polemical and contained much irrelevant commentary on French politics and other like matters. The botanical notes were cursory and in many cases dismissed Hervier's determinations summarily. New combinations, nomenclatural changes and new taxa were included. Many of these have later been effectively published, some validly, some invalidly, by later writers or in Pau's own works. As a result it is difficult to state when many of these new taxa, etc., were in fact published for the first time. Some are unwittingly effected in Cuatrecasas's study on the Macizo de Mágina (1929).

Several of Pau's revised determinations are themselves incorrect as I myself have found. This was also Lacaita's experience. Pau (and this is said quite dispassionately) deliberately attempted to minimize the value of Reverchon's and Hervier's work.

In all fairness it must be admitted that Reverchon's methods of collecting left much to be desired. His localities are generally imprecise, in some cases untraceable; he was not well conversant with the Spanish idiom and consequently invented several absurdities; and his system of enumeration (giving species the same numbers in successive years) has led to much confusion. Finally the exsiccata he distributed were often woefully mixed, containing as many as four distinct taxa under one label; so mixed indeed that Pau, in the *Cartas*, suggested (and in correspondence firmly believed) that Reverchon wilfully misled his subscribers by utilizing material from diverse localities to make up the necessary volume of his exsiccata. It is my own experience that Reverchon's collections from the Albarracín (prov. Teruel) bear an exceedingly close resemblance to those from the province of Jaén: similar abnormal specimens are distributed in his exsiccata from both these areas (and, because of his system of numbering, with the same reference number). But this may be due to a close floristic similarity between the areas which my own investigations have shown, in fact, to exist.

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COTONEASTERS FROM THE EASTERN HIMALAYA

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BY

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(*Academy of Science, Peking*)

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COTONEASTERS FROM THE EASTERN HIMALAYA

By TSE-TSUN YÜ

THE present paper is an enumeration of the Eastern Himalayan species of the genus *Cotoneaster*[1] based mainly on material in the Herbarium of the British Museum (Natural History), London. A few specimens in the Herbarium of the Royal Botanic Gardens, Kew, are also listed. This material comprises the extremely rich collections of F. Ludlow, G. Sherriff, G. Taylor, H. H. Elliot and J. H. Hicks, made during the years 1933 to 1949 in Bhutan and south-eastern Tibet, and that made by O. Polunin in Nepal in 1949. Specimens of F. Kingdon-Ward's collections from Assam, Burma and Tibet, and other collections from the same region, are also included.

Altogether 18 species, 6 with varieties, are represented and these have been placed in 5 series. Two species and a variety are described as new, and in addition 5 species are recorded from the Himalaya for the first time.

The rich material adds both to our understanding of the composition of the flora of this region and our knowledge of the genus *Cotoneaster*. I wish to thank Dr. G. Taylor, Keeper of the Department of Botany, British Museum (Natural History), and Dr. W. B. Turrill, Keeper of the Herbarium and Library, Royal Botanic Gardens, Kew, for giving facilities to consult the herbaria and libraries under their charge.

KEY TO SECTIONS, SERIES AND SPECIES

Petals upright, obovate, pink or red . . . Sect. I. ORTHOPETALUM

Flowers usually solitary, rarely 2–4; leaves usually small, not more than 2 cm. long, obtuse to acutish at the apex . . . . Ser. 1. DISTICHI

Calyx-tube glabrous; habit upright:

Stem more or less distichously branched; flowers solitary, pink; pedicels glabrous, very short; leaves acute and mucronulate or rarely obtuse at the apex, usually appressed-pilose above, glabrous beneath . . . . 1. *distichus*

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[1] In this paper the name *Cotoneaster* is treated as masculine in accordance with the International Code of Botanical Nomenclature (1952), Rec. 83*a* (2): 'generic names which are modern compounds formed from two or more Greek or Latin words should take the gender of the last.' The name was coined in the 16th century by Konrad Gesner from *cotoneum* (quince) and *-aster* (a suffix indicating inferiority or incomplete resemblance) by analogy with the second-declension masculine substantives *oleaster* (from *olea*) and *pinaster* (from *pinus*). As regards pre-Linnaean usage, such phrases as 'baccae cotonastri' and 'cum cotonastro' occurring in J. Bauhin and Cherler (Hist. Pl. Univ. i: 73 (1650)) indicate that cotoneaster (or cotonaster) was accepted as a second-declension noun; such nouns ending in *-er* are masculine.—ED.

Stem irregularly branched:

Flowers 2–3 together, pedicels pubescent, 3–5 mm. long; leaves obtuse or rarely acutish at the apex, appressed-pilose above, nearly glabrous beneath . . . . . . 2. *taylorii*

Flowers solitary, very short-pedicelled; leaves acute or rarely obtuse at the apex, sparingly pilose above, densely pubescent on the nerves beneath . . . . . . 3. *sanguineus*

Calyx pubescent; habit prostrate:

Stem horizontally spreading, usually regularly distichously branched; leaves pubescent beneath; flowers 1–2 together, pink; fruit subglobose, about 5 mm. across . . . . . 4. *horizontalis*

Stem irregularly branched; leaves yellowish-tomentose beneath; flowers solitary, deep red; fruit obovoid, 7–8 mm. long . 5. *rubens*

Flowers in 2–5-flowered pubescent cymes; leaves usually larger, 2–8 cm. long, acute or acuminate at the apex, rarely small and obtuse Ser. 2. ACUMINATI

Fruit red:

Leaves usually small, about 1–3 cm. long, acute or obtuse at the apex:

Leaves pubescent above, at least when young; fruit obovoid, with 3–4 nutlets . . . . 6. *simonsii*

Leaves glabrous above; fruit ovoid, usually with 2 nutlets 7. *divaricatus*

Leaves larger, about 3–8 cm. long, acute or acuminate at the apex:

Leaves pubescent above; fruit ellipsoid, usually with 2 nutlets 8. *acuminatus*

Leaves slightly pubescent or nearly glabrous, rugose or bullate above; fruit subglobose, with 3–5 nutlets . 9. *bullatus*

Fruit black, ellipsoid, usually with 2 nutlets; leaves acute or rarely acuminate at the apex, slightly pubescent or glabrous above 10. *acutifolius*

Petals spreading, suborbicular, usually white . Sect. II. CHAENOPETALUM

Flowers solitary, rarely 3–5(–8) together; leaves usually small (no more than 2 cm. long), obtuse or emarginate at the apex, rarely acutish, pubescent and papillose beneath . . . . Ser. 3. MICROPHYLLI

Flowers solitary; leaves obovate to cuneate-oblong, usually under 10 mm. long . . . . 11. *microphyllus*

Flowers 1–3 together; leaves suborbicular or broad-oval, 8–20 mm. long 12. *rotundifolius*

Flowers few to many together; leaves medium to large, more than 2 cm. long:

Leaves suborbicular to elliptic, obtuse or acute at the apex, up to 3·5 cm. long; nutlets 1, rarely 2 . . . . . . Ser. 4. MULTIFLORI

Leaves glabrous or glabrescent beneath at maturity:

Inflorescences and calyx-tube glabrous; leaves acute or obtuse at the apex . . . . 13. *multiflorus*

Inflorescences and calyx-tube villous; leaves obtuse or retuse at the apex . . . . 14. *hebephyllus*

Leaves tomentose or densely pubescent beneath, usually obtuse and mucronate at the apex; calyx villous or tomentose 15. *racemiflorus*

Leaves ovate, obovate to oblong-lanceolate, acute or acuminate at the apex, up to 10 cm. long; nutlets 2 . . . . . Ser. 5. FRIGIDI

Fruit red, broad-ellipsoid, about 5 mm. long; branchlets, inflorescences and calyx-tube tomentose; leaves tomentose when young, finally nearly glabrous . . . . 16. *frigidus*

Fruit subglobose, reddish-purple to purplish-black, 6–10 mm. across:

Branchlets, inflorescences and calyx-tube slightly pubescent; leaves slightly pubescent at first, soon glabrous 17. *bacillaris*

Branchlets, inflorescences and calyx-tube tomentose; leaves tomentose beneath, finally glabrescent . . . 18. *affinis*

Sect. I. ORTHOPETALUM Koehne

Ser. 1. DISTICHI Yü, ser. nov.

Frutices decidui vel semi-sempervirentes; folia parva, apice obtusa vel acuta; flores solitarii rarius 2–4-nati.

1. **Cotoneaster distichus** Lange in Bot. Tidsskr. Kjöbenh. xiii: 19 (1882).

Cotoneaster rotundifolia sensu Bak. in Saunders, Refug. Bot. i: t. 54 (1869); non Lindl.—Hook. f., Fl. Brit. Ind. ii: 386 (1878).—Hemsl. in Curt., Bot. Mag. cxxxi: t. 8010 (1905).

This species is characterized by its more or less distichously arranged branchlets, which are densely yellowish-strigose when young, by its suborbicular to broad-obovate leaves, with sparse appressed hairs on both sides when young but less so beneath at maturity, by its solitary flowers with glabrous calyx-tube and obtuse calyx-lobes, and by its ovoid or broadly obovoid scarlet fruits which are about 1 cm. long and contain 2–4 nutlets.

The size of its leaves and the indumentum on its branchlets vary considerably. Three varieties in addition to the type are distinguishable in East Himalayan collections.

1a. **Cotoneaster distichus** var. **distichus.**

BHUTAN: Gyasa Dzong, Mo Chu, 2,700 m.; shrub 1 m.; berries scarlet; 3 Oct. 1949, *Ludlow, Sherriff & Hicks 17405*. Yönpu La, 2,400 m.; shrub 1·5 m. on open grassy hillside; 10 Nov. 1938, *Ludlow, Sherriff & Taylor 7223*. Without precise locality, *Herb. Griffith 2107*.

ASSAM: Orka La, Bhutan Frontier, Assam Himalaya, 3,000 m.; stout intricately branched under-shrub; berries scarlet; fl. red; 6 June 1938, *Kingdon-Ward 13697*. Dirang Dzong, 2,400–2,700 m.; dwarf compact shrub 0·5–1 m. high, on the open ridge, but on the fringe of forest in half-sheltered position a large shrub 4–5 m. high or even more, habit fan-like due to a tendency of the branches to grow all in the same plane; berries large, scarlet, numerous; 26 May 1938, *Kingdon-Ward 13678*.

BURMA–TIBET FRONTIER: Adung Valley, sources of the Irrawaddy, 28° 20′ N., 97° 40′ E., 3,600 m.; a prostrate compact shrublet growing on and amongst granite rocks; fl. red; 14 July 1931, *Kingdon-Ward 9807*.

Geographical range: western Himalaya to south-western Yunnan. The following specimens are also referable to this variety: *Forrest 14978, 15811, 15850, 16917, 18298, 19756, 25186, 25215, 25323, 25363, 25966, 26072*; *Rock 23377*; *Schneider 2795*; *Delavay 4168*.

1b. **Cotoneaster distichus** var. **duthieanus** C. K. Schneid., Ill. Handb. Laubh. i: 745 (1906).

BURMA–TIBET FRONTIER: Ata, Zayul, 2,500–2,700 m., 21 Oct. 1933, *Kingdon-Ward 10907*.

Geographical range: Tehri Garhwal (*Duthie* 1061) to Yunnan (*Forrest 24077*).

This variety differs from the typical one in its bigger leaves (15–25 mm. long, 12–18 mm. broad), which are mucronate at apex, and in its longer petioles which are about 4 mm. in length.

1c. **Cotoneaster distichus** var. **verruculosus** (Diels) Yü, comb. nov.

Cotoneaster verruculosa Diels in Not. R. Bot. Gard. Edinb. v: 272 (1912).

BURMA–TIBET FRONTIER: Delei Valley, 28° 21′ N., 96° 37′ E., 3,000–3,300 m.; bushy shrub growing in *Abies-Rhododendron* forest; fl. red; 7 Sept. 1928, *Kingdon-Ward 8395*. Valley of the Nam Tamai, 28° 0′ N., 97° 40′ E., 2,400–2,700 m.; a rigid and angular shrub, in dense thickets along the open ridge, on rock and cliffs on the more exposed flank, the long branches projecting stiffly in all directions, not pressed to the rocks; leaves rounded, rather large, mucronate, not polished; berries small, polished vermilion (on 27 Oct.); 5 Sept. 1937, *Kingdon-Ward 13131*. Mungku Hkyet, 27° 45′ N., 97° 50′ E., 2,700–3,000 m.; a prostrate plant like *C. horizontalis* growing on the rocks along the ridge; berries scarlet; 19 Aug. 1937, *Kingdon-Ward 12982*.

Geographical range: Upper Burma to western and north-western Yunnan. The following specimens also belong to this variety: *Forrest 7737, 8878, 9051, 16094, 17612, 18156, 24077, 25066*.

This variety differs from the type in its densely verruculose branches, due to the persistence of strigose hairs, and in its suborbicular leaves often emarginate at the apex.

The type specimen of *C. verruculosus* (*Forrest 4427*) from Tali, W. Yunnan, has not been examined. In Diels's original diagnosis the species is compared with *C. horizontalis* Decne. and is said to differ in its verruculose branchlets with more persistent stipules, in its still more orbicular leaves, and in the fruits being three times as large. All these characters approach very closely to those of *C. distichus*, except that the latter usually has less verruculose branchlets. The leaves of this species vary on the same plant from orbicular-ovate to obovate or elliptic in general outline, acute to obtuse or emarginate at the apex, broadly cuneate to nearly rounded at base. It seems better to regard *C. verruculosus* as a variety of *C. distichus* rather than as a distinct species.

1*d*. **Cotoneaster distichus** var. **parvifolius** Yü, var. nov.

A typo recedit foliis minoribus, 4–7 mm. longis, 5–6 mm. latis, ramis distichis horizontaliter patentibus; habitu etiam diversa est.

BURMA: Seinghku Wang, base camp, 2,700–3,000 m.; shrub of 1–2 m., more or less erect, with long stiff widely divaricating branches and very small leaves, in tangled wood thickets on the ridge and precipitous slope below; flowers not open; berries brilliant scarlet (on 24 Oct.); 29 May 1926, *Kingdon-Ward 6788* (holotype in Herb. Kew).

Geographical range: Upper Burma to Yunnan. The following specimens from Yunnan belong here: *Forrest 15811, 18188, 20187, 21955, 22568, 23492.*

This variety differs from the type in its horizontally spreading distichously branched stem and in its much smaller usually broad-obovate or orbicular-ovate leaves (4–7 mm. long, 5–6 mm. broad), obtuse or emarginate at the apex. It bears some superficial resemblance to *C. horizontalis* var. *perpusillus* C. K. Schneid., but can be easily distinguished from that plant by the shape of its leaves, by the appressed hairs on its upper leaf-surface, and by its glabrous calyx-tube.

2. **Cotoneaster taylorii** Yü, sp. nov. (Plate 3).

Species ex affinitate *C. distichi* Lange a quo foliis obtusis rarius acutiusculis, inflorescentiis 2–3-floris, recedit.

Frutex vel *arbor parva* 2–3 m. altus; ramuli hornotini pilis fulvido-strigosis dense induti, annotini glabrescentes rubescentes, vetustiores cinereo-brunnei. *Folia* decidua, suborbicularia vel late ovata, apice rotundata vel acutiuscula, basi rotundata rarius late cuneata, 10–12 mm. longa, 9–10 mm. lata, supra laete viridia, utrinque initio parce strigilloso-pilosa, subtus pallidiora mox glabra, nervis lateralibus utroque latere 4–5 ut costa supra leviter impressis subtus obsoletis; petiolus sparse fulvido-pilosulus, 2–3 mm. longus; stipulae membranaceae, lanceolatae, fulvido-pilosulae, 1–2 mm. longae. *Cymae* 2–3-florae, ramulos laterales brevissimos paucifoliosos terminantes, bracteis bracteolisque membranaceis lanceolatis 1–2 mm. longis deciduis munitae; pedicelli 3–5 mm. longi, parce flavido-pilosuli. *Calycis* tubus campanulatus, glaber, 4–5 mm. diam.; dentes late triangulares, obtusi, 1 mm. longi, atrococcinei, margine villosuli. *Petala* erecta, apice rotundata, basi breviter unguiculata, 3 mm. longa, 2 mm. lata, saturate rubra, albo-marginata, caduca. *Stamina* 10,

petalis breviora, glabra, persistentia. *Carpidia* 2, apice pilosa; styli glabri, staminibus breviores. *Fructus* non visus.

S.E. TIBET: below Kongbo Nga La, Takpo, 3,750 m.; shrub or small tree of 3 m. along stream; calyx dark-crimson, lobes fringed with hairs, petals dark-red with white margin; 13 May 1938, *Ludlow, Sherriff & Taylor 4246* (holotype in Herb. Brit. Mus.).

Geographical range: known only from south-eastern Tibet.

This new species is most closely allied to *C. distichus*, from which it differs in its 2–3-flowered cymes, its longer pubescent pedicels, its obtuse, rarely acutish, leaves and its irregularly branching habit.

I take pleasure in naming this species in honour of Dr. G. Taylor, Keeper of Botany, British Museum, who gave me generous help during my visit.

3. **Cotoneaster sanguineus** Yü, sp. nov. (Plate 4).

Species valde affinis *C. rubenti* W. W. Sm., a quo differt foliis ovatis subtus pubescentibus, calycis tubo glabro et habitu diverso.

Frutex 2–3 m. altus, dense ramosus, ramis divaricatis; ramuli juniores pilis flavescentibus strigillosi, basin versus glabrescentes, annotini glabri, sub peridermate cinereo secedenti fusci. *Folia* decidua, ovata vel ovato-elliptica, apice acuta mucronulataque vel rarius obtusa, basi late cuneata vel rotundata, 10–20 mm. longa, 7–12 mm. lata, supra laete viridia sparse pilosa mox glabra, subtus pallidiora ad costam nervosque strigilloso-pubescentia, nervis lateralibus utroque latere 4–5 ut costa supra impressis subtus elevatis; petiolus 3–6 mm. longus, strigilloso-pubescens; stipulae membranaceae, lanceolatae, c. 2 mm. longae. *Flores* terminales, solitarii, subsessiles, basi foliis bracteisque circumcincti. *Calycis* tubus campanulatus, ruber, 7–8 mm. diam.; dentes late triangulares, acuti vel obtusi, 2 mm. longi, dorso fere glabri, margine villosuli. *Petala* erecta vel erecto-patentia, orbiculari-obovata, concava, apice rotundata, basi breviter unguiculata, 4 mm. lata, rubra. *Stamina* 10, petalis aequilonga, rubra. *Carpidia* 2, apice villosa; styli staminibus aequilongi. *Fructus* non visus.

BHUTAN: Pangotang, Bumthang Chu, 3,750 m., shrub on rock and steep slopes, common at edge of *Abies* zone; corolla red; 1 June 1949, *Ludlow, Sherriff & Hicks 19032*.

S.E. TIBET: Karma Valley, 1922, *Norton 236*. Chickchar, Tsari, 3,900 m.; shrub 1·5–2 m., in open scrub jungle; very deep Indian pink; 13 June 1936, *Ludlow & Sherriff 2157* (holotype in Herb. Brit. Mus.). Same locality, 3,600 m.; large shrub with red flowers and hairy leaves, common in thickets and *Abies* forest; 3 July 1935, *Kingdon-Ward 11879*.

Geographical range: south-eastern Tibet and Bhutan to Yunnan and Sikang. The following specimens from south-western China belong here: *Forrest 18696, 18979, 19538, 19664, 26251*.

In its solitary dark-crimson flowers this new species is closely allied to *C. rubens* W. W. Sm., but it can easily be distinguished from that species by its ovate acute leaves, which are pubescent beneath, and by its glabrous calyx-tube. In habit and

general appearance these two species are quite different: *C. rubens* is a low almost prostrate shrub, while *C. sanguineus* is a large upright shrub up to 2 m. high.

4. **Cotoneaster horizontalis** Decne. in Fl. Serres xxii: 168 (1877).

Geographical range: central Nepal to western China.

The typical variety of this species is common in western China. In the eastern Himalaya the following variety is found.

4*a*. **Cotoneaster horizontalis** var. **adpressus** (Bois) C. K. Schneid., Ill. Handb. Laubh. i: 745 (1906).

Cotoneaster adpressa Bois in Vilmorin & Bois, Frutic. Vilmor.: 116 (1905).—Fedde, Repert. Nov. Sp. iii: 226 (1906).—Rehd. & Wils. in Sarg., Pl. Wils. i: 155 (1912).

NEPAL: Kyangjin Ghyang, 4,050 m.; prostrate shrub over rocks; fl. bright pink; 9 June 1949, *Polunin 256*.

BURMA: Seinghku Wang, 28° 8′ N., 97° 24′ E., 3,600–3,900 m.; hanging like drapery from the limestone cliffs to which it clings in huge mats; petals cherry-red, edged with white; 6 July 1926, *Kingdon-Ward 7051*.

S.E. TIBET: Gyantse, 4,050 m.; procumbent shrub among boulders; 12 June 1926, *Ludlow 194*. Hills south of Lhasa, 3,800 m.; growing on rocks; fl. pink; 6 June 1942, *Ludlow & Sherriff 8652*. Same locality, 4,050 m.; prostrate shrub, creeping over rocks on hillside; fl. rose-pink; 21 May 1943, *Ludlow & Sherriff 9512*. Shoga Dzong, Kongbo, 3,150 m.; shrub 0·5–1 m.; 16 Sept. 1947, *Ludlow, Sherriff & Elliot 15733*.

Geographical range: central Nepal through south-eastern Tibet to south-western China.

According to Bois, *C. adpressa* differs from *C. horizontalis* by its irregularly branching habit and by its larger globose fruits, usually with two nutlets, ripening several weeks earlier than those of the latter species. The specimens cited above have branches irregularly arranged at the base but horizontally spreading and distichously arranged near the apex, and their fruits contain two or three nutlets. This leads me to agree with Schneider's view and to regard *C. adpressa* as a variety of *C. horizontalis*.

5. **Cotoneaster rubens** W. W. Sm. in Not. R. Bot. Gard. Edinb. x: 24 (1917).

BHUTAN: between Barshong and Dotena, Thimbu Chu, 3,300 m.; erect shrub 2 m.; 16 Oct. 1949, *Ludlow, Sherriff & Hicks 17528*. Shingbe, Me La, 3,750 m.; shrub 1 m., among boulders of an old overgrown glacier moraine; fl. red; 14 June 1949, *Ludlow, Sherriff & Hicks 20364*.

BURMA–TIBET FRONTIER: Seinghku Wang, 28° N., 97° 24′ E., 3,600 m.; a small tangled bush or under-shrub, growing on grass-clad slopes or in thickets; petals cherry-red; berries scarlet; 6 July 1926, *Kingdon-Ward 7050*. Adung Valley, sources of the Irrawady, 3,600 m., 8 June 1931, *Kingdon-Ward 9613*. Nam Tamai Valley, Ka Karpo Kazi, 28° 15′ N., 97° 30′ E., 3,600–3,900 m.; under-shrub of spreading habit, sometimes gregarious or forming colonies in the open wet alpine pasture; berries large, red; 8 Oct. 1937, *Kingdon-Ward 13387*.

S.E. TIBET: Lusha Chu, Kongbo, 3,750 m.; low almost prostrate shrub up to 0·3 m. high, in rocky places; petals deep red; 9 June 1938, *Ludlow, Sherriff & Taylor 4730.*

Geographical range: south-eastern Tibet through Upper Burma and Yunnan. The following specimens from Yunnan belong here: *Forrest 12663, 14246, 14890, 19653, 21493, 22271, 23519.*

This strikingly distinct species is easily recognized by its prostrate and irregularly branching habit, by its suborbicular to broad-elliptic leaves which are rounded at both ends and densely yellowish-tomentose beneath, and by its solitary deep-red flowers with densely pubescent calyx-tube. It has not previously been recorded from the eastern Himalaya.

Ser. 2. ACUMINATI Yü, ser. nov.

Frutices decidui; folia apice acuminata vel rarius obtusa; cymae 2–5-florae.

6. **Cotoneaster simonsii** Bak. in Saunders, Refug. Bot. i: t. 55 (1869).

NEPAL: Gadbribasa, Khaptar, 29 May 1929, *Bis Ram 583.*

BHUTAN: Seum La, Timpu, 2,250 m.; bush 2 m.; fl. pink; 8 July 1914, *Cooper 1452.*

Geographical range: western and central Himalaya, eastwards to Bhutan.

This species constitutes to some extent a transition between the Series *Distichi* and the Series *Acuminati*. It is apparently very closely allied, on the one hand, to *C. acuminatus* Lindl., but differs in its much smaller leaves and fruits, and in its shorter 2-(rarely 4-)flowered cymes. On the other hand, it approaches *C. distichus* from which, however, it is easily distinguished by its irregularly branching habit, by its ovate leaves sparsely pubescent above and densely so beneath, and by its pubescent calyx-tube.

7. **Cotoneaster divaricatus** Rehd. & Wils. in Sarg., Pl. Wils. i: 157 (1912).

S.E. TIBET: Molo, Kongbo, 3,000 m.; shrub 1·5–2·5 m., in *Abies* and mixed forest; corolla rose-pink, margined white; 26 June 1938, *Ludlow, Sherriff & Taylor 5671.*

Geographical range: south-eastern Tibet to western China; new to the eastern Himalaya.

I refer this plant to *C. divaricatus* but not without hesitation. Its upright habit and its ovate or elliptic, acute or obtuse leaves agree well with those of *C. divaricatus*, but the under surface of the leaves is much more densely covered with villous hairs than in the typical form from western China. It can also be compared with the common Eurasian *C. integerrimus* Medic., which is also recorded from the western Himalaya, but the pubescent cymes and acute calyx-lobes of our material make it impracticable to refer it to that species.

8. **Cotoneaster acuminatus** Lindl. in Trans. Linn. Soc. Lond. xiii: 101, t. 9 (1821).

NEPAL: Foketey, 3,900–4,200 m.; fl. white; 1930, *Lall Dhwoj 0498.* Langtang, 3,600 m.; amongst birch trees and *Rhododendron campanulatum*; 7 June 1949, *Polunin 179.* Same locality; 6 m., in birch wood and shrubbery; fl. solitary, white with a touch of pink; 23 June 1949, *Polunin 545*. Between Langtang and Birdim, 3,600 m.; up to 6 m.; fl. white; 28 June 1949, *Polunin 706*. Lende Khola; in pine forest; fl. white; 9 July 1949, *Polunin 884*. Without precise locality, 1818, *Wallich* (holotype).

BHUTAN: Mem La, Paro Chu, 3,300 m.; shrub up to 2 m.; autumn colour bright red; fl. not seen; berries bright red; 18 Oct. 1949, *Ludlow, Sherriff & Hicks 17485*. Bela La, near Paro, 3,300 m.; shrub 2·5 m., in forest; fl. reddish-pink; 28 June 1933, *Ludlow & Sherriff 167*. Barshong, Timpu, 3,750 m.; bush 3 m.; 26 July 1914, *Cooper 1901*. Between Laya and Gyasa Dzong, 3,300 m.; shrub 1·5–2 m., growing by the banks of streams; fl. reddish-pink; 10 June 1949, *Ludlow, Sherriff & Hicks 16481*. Near Laya, Upper Mo Chu, 3,300 m.; shrub 2–2·5 m.; 30 Sept. 1949, *Ludlow, Sherriff & Hicks 17353*.

ASSAM: Dirang Dzong, 2,400–2,700 m., shrub in thickets on the hillside in steep rocky places; fl. pink, calyx silky-pubescent; leaves and shoots silky-pubescent; berries red; 18 June 1938, *Kingdon-Ward 13767*.

S.E. TIBET: Kongbo Nga La, Takpo, 3,600 m., 22 Oct. 1947, *Ludlow, Sherriff & Elliot 13347*. Bimbi La, Tsari, 3,750 m.; on north-facing slopes; in fruit; leaves scarlet; 13 Oct. 1938, *Ludlow, Sherriff & Taylor 6301*. Langong Chu Valley, Kongbo, 3,450 m.; shrub 1–2·5 m., in *Abies* and *Rhododendron* forest; corolla deep rose-pink; 12 June 1938, *Ludlow, Sherriff & Taylor 5533*. Molo, Langong Chu, Kongbo, 3,300 m.; shrub 1–1·5 m., growing among Rhododendrons in *Abies* forest; fl. rose-pink; 24 May 1938, *Ludlow, Sherriff & Taylor 3836*. Valley of Lilung Chu, Kongbo, 3,180 m.; shrub up to 2·5 m. with long branches, on bank of river in shade of *Quercus*; petals white flushed reddish outside; 24 May 1938, *Ludlow, Sherriff & Taylor 4423*. Nyoto Sama, Kongbo, 3,600 m.; shrub 1·5 m. high, by side of river; 12 Aug. 1947, *Ludlow, Sherriff & Elliot 15610*. Lokmo, near Tongyuk Dzong, Pome, 3,450 m.; shrub 1–1·5 m.; fl. rosy-red; 2 June 1947, *Ludlow, Sherriff & Elliot 13816*.

Geographical range: western Himalaya to south-western China. The following specimens from south-western China belong to this species: Yunnan: *Forrest 2301, 5567, 5604, 11289, 20603, 22209, 23592*; *Maire 510*; *Delavay 3103, 4337*; *McLaren's collector 34*; *Rock 25093*. Sikang: *Rock 23791*; *Schneider 1566*.

This species is very easily recognized by its elliptic-ovate to ovate-oblong leaves which are acuminate or acute at the apex, broad-cuneate at the base, pubescent on both sides and densely so beneath, sometimes glabrescent at maturity; by its 2–5-flowered pubescent cymes with pinkish flowers and pubescent calyx; and by its ellipsoid fruits, 8–10 mm. long, bright red, hairy near the apex, with 2 nutlets.

9. **Cotoneaster bullatus** Bois in Vilmorin & Bois, Frutic. Vilmor.: 119 (1905).—Fedde, Repert. Nov. Sp. iii: 228, figs. 3, 4 (1906).

S.E. TIBET: Between Lepo and Trimo, Nyamjang Chu, Mönyul, 2,700–3,000 m.; tree up to 8 m., in mixed forest; fruits red; 1 Nov. 1938, *Ludlow, Sherriff & Taylor 6441*. Ata, Zayul, 2,400–3,000 m.; forest shrub with scarlet berries; 21 Oct. 1933, *Kingdon-Ward 10906*.

Geographical range: south-eastern Tibet to western China (Hupeh, Szechwan, Sikang, Yunnan); new to the eastern Himalaya.

This species is closely allied to *C. acuminatus*, but is easily distinguished by its larger leaves, rugose and more or less bullate above, and by its red subglobose fruits, usually with 3–4 nutlets.

10. **Cotoneaster acutifolius** Turcz. in Bull. Soc. Imp. Nat. Mosc. v: 190 (1832).

10*a*. **Cotoneaster acutifolius** var. **acutifolius.**

S.E. TIBET: Shoga Dzong, Kongbo, 4,200 m.; shrub 1–2 m. high; 15 Sept. 1947, *Ludlow, Sherriff & Elliot 15715*. Shugden Gompa, Nagong, 3,900–4,200 m.; shrub 2·5–4 m. high, on sheltered slopes with other shrubs; foliage colouring brilliantly; fruits black, solitary or few together; 7 Oct. 1933, *Kingdon-Ward 10897*.

Geographical range: originally described from Mongolia; also recorded from northern and north-western China; new to the eastern Himalaya.

This species is similar in most respects to *C. acuminatus*, but its fruits are black and its leaves nearly glabrous at maturity.

10*b*. **Cotoneaster acutifolius** var. **villosulus** Rehd. & Wils. in Sarg., Pl. Wils. i: 158 (1912).

BURMA–TIBET FRONTIER: Rong Tö Valley, 1,800 m.; shrub, common in thickets in the gullies or on sheltered slopes; fl. pink; 19 Apr. 1933, *Kingdon-Ward 10347*.

S.E. TIBET: Gautsa to Yatung, 3,050–3,650 m., 17 July 1938, *Gould 1521*. Dzeng, Tsangpo Valley, Kongbo, 2,850 m.; shrub up to 2·5–3 m., in thick *Quercus* scrub at bottom of shady ravine; fruits shiny black, sparingly hairy; 12 Sept. 1938, *Ludlow, Sherriff & Taylor 6996*. Chutang Camp, near Ata, Zayul, 2,700–3,000 m.; forest shrub with black berries; leaves woolly beneath; 21 Oct. 1933, *Kingdon-Ward 10913*.

Geographical range: south-eastern Tibet to western and north-western China (Kansu, Shensi, Hupeh, Szechwan, Sikang); new to the eastern Himalaya.

This variety differs from the type in its large acuminate leaves, more densely villous beneath, in its densely villous calyx and in its thinly pubescent fruits.

Sect. II. CHAENOPETALUM Koehne

Ser. 3. MICROPHYLLI Yü, ser. nov.

Frutices sempervirentes; folia parva; flores solitarii rarius 3–5(–8)-nati; pyrenae 2.

11. **Cotoneaster microphyllus** Wall. ex Lindl. in Edw., Bot. Regist. xiii: t. 1114 (1828).

11*a*. **Cotoneaster microphyllus** var. **microphyllus.**

NEPAL: Rolwa Leng, 4,800–5,400 m., 1930, *Lall Dhwoj 0663*.

BHUTAN: Cheli La, 2,700–3,300 m.; plastered over boulders; fl. white; 4 May 1949, *Ludlow, Sherriff & Hicks 16142*. Tranza, Upper Pho Chu, 3,900 m.; sprawling over rocks and boulders; fruit bright scarlet; 20 Sept. 1949, *Ludlow, Sherriff & Hicks 17264*. Without precise locality, *Herb. Griffith 2108* in part.

BURMA–TIBET FRONTIER: Adung Valley, sources of the Irrawaddy, 28° 20′ N., 97° 40′ E., 3,600–3,900 m.; low spreading under-shrub moulding itself on granite boulders in the short scrub, absolutely prostrate on the steep fine gravel screes and earth slides, abundant chiefly on the more sheltered side of the valley; fl. white; 30 June 1931, *Kingdon-Ward 9725*.

S.E. TIBET: Tangmochi, 4,200 m., 20 June 1936, *Humphreys 5021*. Chongphu Chu, 1922, *Norton 62*. Same locality, 3,600 m., 6 July 1933, *Wager 234*. Rongshar Valley, 3,600 m., 1924, *Hingston 107*. Yatung, 1897, *Hobson*. Kyimpu, Chayul–Charme road, Charme, 3,450 m.; creeping shrub, growing on rocks and bare hillside; corolla white; 11 May 1936, *Ludlow & Sherriff 1576*. Chösam, Tsari Chu, Tsari, 3,900 m.; shrub 4–5 ft., growing over bare rocks; bright blush-pink, very fragrant; 16 May 1936, *Ludlow & Sherriff 1602*. Bimbi La, Tsari, 3,750 m.; dwarf prostrate shrub; berries scarlet; 13 Oct. 1938, *Ludlow, Sherriff & Taylor 6306*. Rima, Zayul, 1,200–1,500 m.; compact low scrub plant, not more than 60 cm. high, but spreading; petals white, stamens purple; berries scarlet; leaves polished above with scattered hairs, silver-tomentose beneath; 8 Apr. 1933, *Kingdon-Ward 10334*.

Geographical range: throughout the Himalaya and eastward to south-western China. The following specimens also belong here: Yunnan: *Forrest 2311, 16890, 16939, 16954, 17066, 19140, 20552, 22284*; *Rock 22331, 22816, 25064*; *Schneider 2800, 3258*. Sikang: *Schneider 589, 1063*; *Pratt 543*.

An evergreen low shrub with spreading branches; leaves obovate to obovate-oblong, obtuse or emarginate (rarely acutish) at the apex, cuneate at the base, glaucous and pubescent beneath; flowers usually solitary, rarely 2–3 together, with pubescent calyx; fruits globose, scarlet, with 2 nutlets.

By the variation of indumentum on leaves and calyx and of the size of leaves and fruits, three varieties in addition to the type can be distinguished in this region.

11*b*. **Cotoneaster microphyllus** var. **glacialis** Hook. f., Fl. Brit. Ind. ii: 387 (1878).

Cotoneaster congesta Bak. in Saunders, Refug. Bot. i: t. 51 (1869).

BHUTAN: Me La, south side, 3,900 m.; growing flat on rocks; fl. white; 27 May 1949, *Ludlow, Sherriff & Hicks 20296*.

BURMA–TIBET FRONTIER: Mago, Tulung La, 4,200–4,500 m.; like *C. microphyllus*, absolutely prostrate on rocks; berries large, brilliant-red; 4 Oct. 1935, *Kingdon-Ward 12386*.

S.E. TIBET: Nambu La, Kongbo, 4,050 m.; on dry rocks; 26 Sept. 1947, *Ludlow, Sherriff & Elliot 15782*.

Geographical range: eastern Himalaya to south-eastern Tibet.

This variety differs from the typical variety in its leaves and calyx being slightly pubescent at first, becoming glabrous or nearly so at maturity.

11*c*. **Cotoneaster microphyllus** var. **cochleatus** (Franch.) Rehd. & Wils. in Sarg., Pl. Wils. i: 176 (1912).

Cotoneaster buxifolia forma *cochleata* Franch., Pl. Delavay.: 244 (1890).

NEPAL: Khuptur Forest; small creeping shrub on rocks; 3 June 1929, *Bis Ram 527*. Between Thare and Bhragu, 2,130 m.; low semi-prostrate shrub; fl. white; 3 June

1949, *Polunin 091*. Below Langtang, 3,350 m.; fl. white; 25 June 1949, *Polunin 582*.

BHUTAN: Khöma, Jumu Chu, 2,440 m.; prostrate shrub on steep open banks and over rocks; fl. white; 2 May 1949, *Ludlow, Sherriff & Hicks 18810*. Trashiyangsi Dzong, 1,650 m.; shrub 1–1·5 m.; fl. white; 26 Apr. 1949, *Ludlow, Sherriff & Hicks 20193*.

Geographical range: central Himalaya to south-western China.

This variety diverges from the typical one in its leaves and calyx being densely white-villous and its leaf-margin being revolute.

11*d*. **Cotoneaster microphyllus** var. **conspicuus** Messel in Gard. Chron., Ser. 3, xciv: 299 (1933).

Cotoneaster conspicua Messel in Journ. R. Hort. Soc. Lond. lix: 303 (1934).—J. Comber in Gard. Chron., Ser. 3, xcix: 388 (1936).—Marquand in Bull. Misc. Inf. Kew 1937: 119 (1937); in Gard. Chron., Ser. 3, ci: 286 (1937); in Curt., Bot. Mag. clxi: t. 9554 (1939).—H. F. Comber in Gard. Chron., Ser. 3, cxxxi: 159 (1952).

Cotoneaster conspicua var. *decora* Paul Russell in Proc. Biol. Soc. Wash. li: 184 (1938).—Stearn in Journ. R. Hort. Soc. Lond. lxiv: 243 (1939).

S.E. TIBET: Yusum, Tsangpo Valley, Kongbo, 2,850 m., 13 Oct. 1947, *Ludlow, Sherriff & Elliot 13310*. Pe, Tsangpo Valley, Kongbo, 2,850 m., 23 Sept. 1947, *Ludlow, Sherriff & Elliot 13288*. Kyikar, Tsangpo Valley, Kongbo, 3,300 m.; low procumbent shrub; fl. white tinged pink; 23 Apr. 1947, *Ludlow, Sherriff & Elliot 13533*. Langpe, Tsangpo Valley, near Gyala, Kongbo, 2,790 m.; low spreading shrub up to 60 cm., on rocks; immature fruit green, tinged crimson; 21 July 1938, *Ludlow, Sherriff & Taylor 5344*. Gyala, Tsangpo Valley, Kongbo, 2,790 m.; spreading over boulders; fl. white with a pinkish tinge; 24 Apr. 1947, *Ludlow, Sherriff & Elliot 13545*.

Geographical range: apparently confined to south-eastern Tibet.

This variety differs from the type in its more spreading habit and its larger leaves and fruits.

Marquand described *C. conspicua* from garden material raised from seed (*Kingdon-Ward 6400*) collected in 1924 at Gyala, Tibet. Through a misunderstanding, the most vigorous plant grown at Nymans, Sussex, having attained some height, was incorrectly described as 'erect'. However, from the number of specimens from Tibet and the Himalaya which I have examined, it is clear that *C. microphyllus* is low and prostrate in open and wind-swept sites, but grows up to a height of more than a metre, with spreading branches, in sheltered positions. The plant growing in favourable conditions usually has bigger leaves and fruits, but this is merely ecological variation and does not justify specific recognition. H. F. Comber has shown that it is not possible to distinguish an 'erect' type (*conspicua*) and a prostrate variety (*decora*).

12. **Cotoneaster rotundifolius** Wall. ex Lindl. in Edw., Bot. Regist. xv: sub t. 1229 (1829).

12*a*. **Cotoneaster rotundifolius** var. **rotundifolius.**

Cotoneaster prostrata Bak. in Saunders, Refug. Bot. i: t. 53 (1869).

BHUTAN: Leji, Upper Pho Chu, 3,600 m.; growing on cliffs and boulders; berries scarlet; 24 Sept. 1949, *Ludlow, Sherriff & Hicks 17282*.

S.E. TIBET: Sanga Chöling, Char Chu, Charme, 3,150 m.; shrub 1–1·5 m.; 27 Sept. 1936, *Ludlow & Sherriff 2709*. Taktsa, near Kyimdong Dzong, Takpo, 3,900 m.; shrub 1 m., dry zone, on stony hillside; 19 Sept. 1936, *Ludlow & Sherriff 2614*. Molo, Kongbo, 3,150 m.; shrub 4–5 ft., on open river banks; corolla white tinged pale pink; 26 June 1938, *Ludlow, Sherriff & Taylor 5677*. Dzala, Pasum Chu, Kongbo, 3,750 m.; shrub 3–4 ft.; white; 1 July 1947, *Ludlow, Sherriff & Elliot 14051*.

Geographical range: from Kashmir to south-western China (Yunnan).

The following specimens from Yunnan belong to this species: *Forrest 5570, 22229*; *Rock 22077*.

This is a handsome species with arching branches, most closely allied to *C. microphyllus*, from which it is easily distinguishable by its broadly ovate to suborbicular leaves, rounded or acutish at the apex, broad-cuneate or rounded at the base, by its 2–3- (rarely 1-) flowered cymes, and by its bigger subglobose fruits about 7–9 mm. across.

12b. **Cotoneaster rotundifolius** var. **lanatus** (Dipp.) C. K. Schneid., Ill. Handb. Laubh. i: 759 (1906).

S.E. TIBET: Lusha Chu, Kongbo, 29° 20′ N., 94° 55′ E., 3,000 m.; low spreading bush of 1 m.; petals white, filaments white, anthers reddish-purple, ovary green, style reddish-purple; 15 June 1938, *Ludlow, Sherriff & Taylor 4821*.

Geographical range: western Himalaya to south-eastern Tibet.

This variety is easily recognized by its broad elliptic leaves, tomentose beneath, and by its 3–5-flowered cymes.

Ser. 4. MULTIFLORI Yü, ser. nov.

Frutices decidui; folia suborbicularia, ovata vel elliptica, apice obtusa vel acuta; inflorescentiae 3–12-florae, rarius multiflorae; pyrenae 1 rarius 2.

13. **Cotoneaster multiflorus** Bunge in Ledeb., Fl. Alt. ii: 220 (1830).

S.E. TIBET: Nang Dzong, Tsangpo Valley, Takpo, 3,000 m.; tree of 5 m., with long spindly branches; petals crimson in bud, white flushed pink when open; 13 May 1938, *Ludlow, Sherriff & Taylor 4240*. Tsela Dzong, Tsangpo Valley, Kongbo, 3,000 m.; fl. white; 31 May 1924, *Kingdon-Ward 5722*. Tamnyen, Tsangpo Valley, Kongbo, 2,880 m.; growing in dry ground; fl. white; 26 May 1947, *Ludlow, Sherriff & Elliot 15062*. Deyang, Tsangpo Valley, Kongbo, 2,850 m.; shrub up to 2 m., growing in hedges bordering cultivation; corolla whitish-pink; 13 May 1947, *Ludlow, Sherriff & Elliot 13676*. Pe, Tsangpo Valley, Kongbo, 2,850 m.; shrub or tree up to 3–5 m. high, growing in hedges; berries port-wine red; 7 Aug. 1947, *Ludlow, Sherriff & Elliot 14441*.

Geographical range: south-eastern Tibet to western and northern China (Hopei, Shansi, Shensi, Kansu, Sikang).

The species can easily be recognized by its branchlets, leaves, and inflorescences being only slightly tomentose when young but very soon becoming glabrous, by its large white flowers in loose corymbs, and by its red subglobose or obovoid fruits usually with a single nutlet.

14. **Cotoneaster hebephyllus** Diels in Not. R. Bot. Gard. Edinb. v: 273 (1912).

S.E. TIBET: Salween Gorge, Chamdo district, 3,600–3,900 m.; shrub with white scented flowers, on sheltered limestone cliffs and steep slopes; 5 Aug. 1933, *Kingdon-Ward 10693*. Upper Yigrong Valley, 3,600 m.; large shrub, in thickets on open cliff; fruits carmine; 16 Aug. 1935, *Kingdon-Ward 12218*.

Geographical range: south-eastern Tibet to Yunnan; new to the eastern Himalaya.

15. **Cotoneaster racemiflorus** (Desf.) C. Koch, Dendrologie i: 170 (1869).

Geographical range: southern Europe, north Africa, through western Asia to the eastern Himalaya.

A very variable species with many varieties, only one of which occurs in the eastern Himalaya.

15*a*. **Cotoneaster racemiflorus** var. **songoricus** (Regel & Herder) C. K. Schneid., Ill. Handb. Laubh. i: 754 (1906).

Cotoneaster nummularia sensu Hook. f., Fl. Brit. Ind. ii: 386 (1879) pro parte; non Fisch. & Mey.

BHUTAN: Tsalimape, 2,100 m.; shrub 1–1·5 m., on open rather dry hillside with *Ceratostigma griffithii*; fruits a very fine coral red colour and very profuse; 23 Aug. 1949, *Ludlow, Sherriff & Hicks 19632*.

S.E. TIBET: Pheng Chu, *Norton 109*. Gyantse, 4,000 m.; shrub on rocks; petals white, pinkish underneath; 11 June 1925, *Ludlow 130*. Lhasa, 3,540 m.; shrub up to 2·5 m., in parks and open woodland; fl. white; 1 June 1942, *Ludlow & Sherriff 8626*. Same locality, 3,600 m.; shrub 3–4 m., among willows and poplars; fl. white; 28 May 1943, *Ludlow & Sherriff 9525*. Same locality; shrub 2·5–3 m., among willows and poplars; fl. white, sweet-scented; 12 June 1943, *Ludlow & Sherriff 9570*. Loro Chu, 3,300–3,600 m.; free flowering bushy shrub, common round cultivation; fl. white; inflorescences, shoots and under leaf-surface white-tomentose; 18 June 1935, *Kingdon-Ward 11733*. Charme, Char Chu, Charme, 3,150 m.; shrub 1–2 m., among other shrubs on stony hillside, dry valley; corolla and filaments cream-white, anthers dull-brown; fragrant; 2 July 1936, *Ludlow & Sherriff 2271*. Above Charme, Charme, 3,150 m.; shrub up to 2·5 m., dominant at this altitude on the south-facing slopes; in fruit; 22 Oct. 1938, *Ludlow, Sherriff & Taylor 6391*. Tromda, Tsangpo Valley, Takpo, 3,300 m.; bush of 1·5 m., beside small dam in irrigation channel; sepals with purple tips, petals white; 11 May 1938, *Ludlow, Sherriff & Taylor 4203*. Near Oro, Tsangpo Valley, Takpo, 3,300 m., 11 May 1938, *Ludlow, Sherriff & Taylor 4203a*. Nang Dzong, Tsangpo Valley, Takpo, 3,150 m.; shrub 1–2·5 m., common along the dry Tsangpo Valley, where side streams come down; corolla white; 2 May 1947, *Ludlow, Sherriff & Elliot 12433*. Rima, 1,200–1,500 m.; a large bushy shrub abundant in open thickets on the dry side of the valley; fl. white, fragrant; 11 Apr. 1933, *King-*

don-Ward 10335. Ata, Rong Tö Valley, Zayul, 2,400 m.; large shrub in thickets by the river; fl. white, fragrant; 29 May 1933; *Kingdon-Ward 10439*.

Geographical range: western Himalaya to north-western and north-eastern China (Sikang, Szechwan, Kansu, Shantung, Hopei).

This variety differs from the type by its oval or ovate leaves, usually obtuse and mucronate at the apex, and by its less densely tomentose inflorescences, calyx and under surface of leaves.

Ser. 5. FRIGIDI Yü, ser. nov.

Frutices vel arbusculae decidui; folia ovata, obovata vel oblongo-lanceolata, apice acuta vel acuminata; corymbi multiflori; pyrenae 2.

16. **Cotoneaster frigidus** Wall. ex Lindl. in Edw., Bot. Regist. xv: t. 1229 (1829).

NEPAL: Langtang and lateral valleys, 3,350 m.; shrub 4–6 m.; in thickets; fl. white; 25 June 1949, *Polunin 592*. Between Langtang and Birdim, 2,740–3,200 m.; shrub up to 12 m.; fl. white; 28 June 1949, *Polunin 702*.

BHUTAN: Drugye Dzong, Paro Chu, 2,550 m.; berries red; 19 Oct. 1949, *Ludlow, Sherriff & Hicks 17489*. Shabjetang, Bumthang Chu, 3,000 m.; tree 5 m., on dry river bank; corolla white; 9 June 1949, *Ludlow, Sherriff & Hicks 19083*. Trashiyangsi Dzong, 1,620 m.; small tree 6 m., amongst bushes and small trees on dry hillside; fl. white, with a pleasant nutty scent; 26 Apr. 1949, *Ludlow, Sherriff & Hicks 20195*.

S.E. TIBET: Pangchen, Nyamjang Chu, Mönyul, 2,100 m.; tree 3–5 m., in forest clearings and steep hillside; corolla white; 25 May 1947, *Ludlow, Sherriff & Elliot 12555*. Lepo, Nyamjang Chu, Mönyul, 2,700 m.; tree up to 6 m.; fruits red; 1 Nov. 1938, *Ludlow, Sherriff & Taylor 6438*. Trimo, Nyamjang Chu, Mönyul, 3,300 m.; tree 6–11 m., in open spaces of *Rhododendron* and conifer forest; fruits dull scarlet; 11 Nov. 1938, *Ludlow, Sherriff & Taylor 6667*.

Geographical range: central to eastern Himalaya.

This species is a tall shrub or small tree characterized by its elliptic to elliptic-oblong or oblong-obovate, obtuse or acutish leaves tomentose beneath while young, finally glabrous; by its large tomentose many-flowered corymbs; by its tomentose calyx-tube and acute sepals; and by its red broad-ellipsoid fruits about 5 mm. long.

17. **Cotoneaster bacillaris** Wall. ex Lindl. in Edw., Bot. Regist. xv: sub t. 1229 (1829).—Spach, Hist. Nat. Vég., Phan. ii: 781 (1834).—Hook. f., Fl. Brit. Ind. ii: 384 (1878).

Cotoneaster obtusa Wall. ex Lindl., loc. cit. (1829).
Cotoneaster affinis var. *bacillaris* (Lindl.) C. K. Schneid., Ill. Handb. Laubh. i: 757 (1906).—Rehd., Man. Cult. Trees & Shrubs, ed. 2: 354 (1940).
Cotoneaster cooperi Marquand in Hook., Ic. Pl. xxxii: t. 3146 (1930).

KUMAON: Binsar, 2,130 m., *Strachey & Winterbottom 1*. Without precise locality, *Wallich 659* in part; *Blinkworth 660* (type of *C. bacillaris*).

BHUTAN: Ha, 2,700–3,300 m.; shrub 10–15 ft., in scrub jungle; fl. white; 12 June 1933, *Ludlow & Sherriff 81*. Saga La, near Drugye Dzong, 3,000 m.; shrub 5 m., in conifer forest; corolla white; 10 May 1949, *Ludlow, Sherriff & Hicks 16175*. Tsalimape, 2,400 m.; tree or shrub 2–2·5 m.; fl. not seen, said to be white; fruits dark red and very plentiful; 10 Aug. 1949, *Ludlow, Sherriff & Hicks 19595*. Without precise locality, *Herb. Griffith 1980, 1981, 2106*.

Geographical range: along the Himalaya from Kashmir to Bhutan.

This is a very common and variable species along the Himalaya. Its leaves vary from oblong to obovate or oblong-lanceolate, and are acute or obtuse or rarely shortly acuminate at the apex, cuneate at the base, 3–8 cm. long, 1·5–3·5 cm. broad, glabrous above and slightly villous beneath, eventually glabrescent, with petioles 5–8 mm. long. The inflorescences are sparingly villous at first, finally glabrous. The fruits are dark reddish-purple to nearly black, subglobose or turbinate, 8–10 mm. long, 6–7 mm. across. It is very nearly allied to *C. affinis*, which usually has shorter and broader, ovate or elliptic leaves densely tomentose beneath when young, and more congested inflorescences with the peduncle, pedicels and calyx densely tomentose.

The type specimen of *C. cooperi* is from a garden plant raised from seeds collected by R. E. Cooper in Bhutan. It has a looser inflorescence and less hairy and more pointed leaves than the wild specimen from the same locality. The slight differences seem to have been induced by the alteration in habitat through cultivation.

18. **Cotoneaster affinis** Lindl. in Trans. Linn. Soc. Lond. xiii: 101 (1821); in Edw., Bot. Regist. xv: sub t. 1229 (1829).—C. K. Schneid., Ill. Handb. Laubh. i: 757 (1906).

Mespilus affinis (Lindl.) D. Don, Prodr. Fl. Nepal.: 238 (1825).
Cotoneaster frigida var. *affinis* (Lindl.) Wenzig. in Linnaea xxxviii: 194 (1874).
Cotoneaster bacillaris var. *affinis* (Lindl.) Hook. f., Fl. Brit. Ind. ii: 385 (1878).
Cotoneaster affinis var. *typica* C. K. Schneid., Ill. Handb. Laubh. i: 757 (1906), *nom. illegit.*

PUNJAB: Dimanjan Dogri, Baspa Valley, Simla Hill States, 3,800 m.; shrub 2–2·5 m., in *Abies* forest; fl. white; 12 July 1939, *Sherriff 7428*.

KUMAON: without precise locality, *Blinkworth*.

NEPAL: Chittong, 14 Apr. 1802, *Buchanan* (holotype). Kali Valley, near Kawa, 3,000–3,300 m., 28 July 1886, *Duthie 5528*. Lende Khola, 2,290 m.; bush 8 m.; fl. white; 9 July 1949, *Polunin 902*. Without precise locality, 1829, *Wallich 658*.

S.E. TIBET: Rongshar Valley, 2,900 m., 24 June 1924, *Hingston 171*. Same locality, 3,350 m., 24 June 1924, *Hingston 232*.

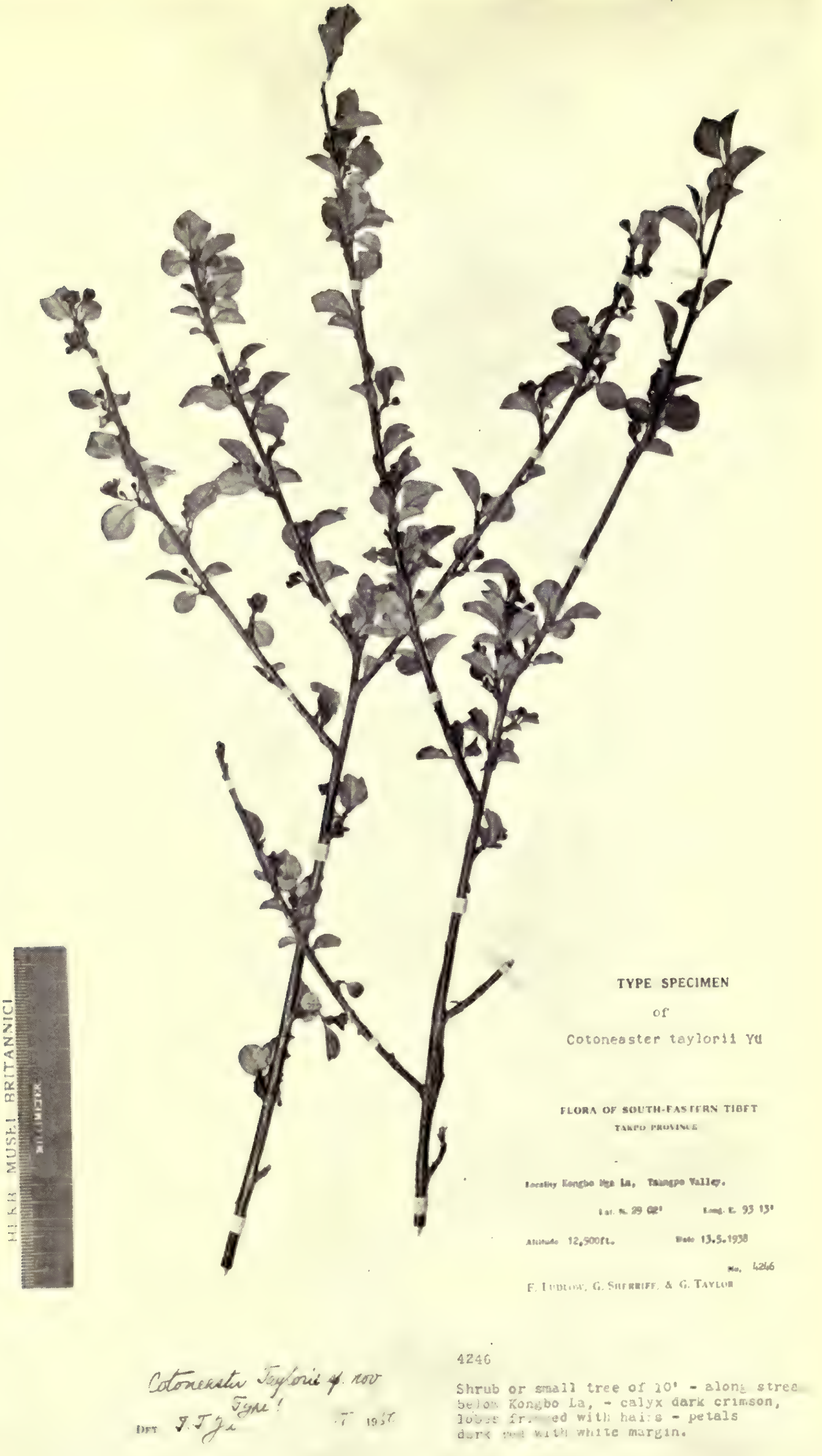
Geographical range: western Himalaya to south-eastern Tibet.

This species is very nearly related to *C. bacillaris* and *C. frigidus*. It differs from *C. bacillaris* by its leaves being densely villous or tomentose beneath and by its more congested and densely villous inflorescences. From *C. frigidus* it differs by having fewer flowers in an inflorescence usually less than 4 cm. across, and by its dark purple fruits. Although J. D. Hooker treated *C. affinis* as a variety of *C. bacillaris* and C. K. Schneider treated *C. bacillaris* as a variety of *C. affinis*, both authors thus regarding them as conspecific, after careful examination of the type specimens I prefer to follow Lindley and retain them as distinct species.

From the following table it can be seen that, of the *Cotoneaster* species inhabiting the eastern Himalaya, only about one-half occur in the western Himalaya, while more than two-thirds occur in western and south-western China. One species has a Eurasian distribution. This is apparently in accordance with the general composition of the floristic elements of this area, and is evidently due to the greater similarity of the climatic and edaphic conditions of the eastern Himalaya region to those of Sikang and Yunnan than to those of the western Himalaya.

Table of General Distribution

Series	*Species*	*Western Himalaya*	*W. & S.W. China*	*N. China*	*W. Asia*	*Europe*
1	*C. distichus*	+	+			
	C. taylorii					
	C. sanguineus		+			
	C. horizontalis		+			
	C. rubens		+			
2	*C. simonsii*	+				
	C. divaricatus		+			
	C. acuminatus	+	+			
	C. bullatus		+			
	C. acutifolius		+	+		
3	*C. microphyllus*	+	+			
	C. rotundifolius	+	+			
4	*C. multiflorus*		+	+		
	C. hebephyllus		+			
	C. racemiflorus	+	+	+	+	+
5	*C. frigidus*					
	C. bacillaris	+				
	C. affinis	+				
Total	18	8	13	3	1	1
Percentage	..	44	72	17	5	5



TYPE SPECIMEN
of
Cotoneaster taylorii Yü

FLORA OF SOUTH-EASTERN TIBET
TAKPO PROVINCE

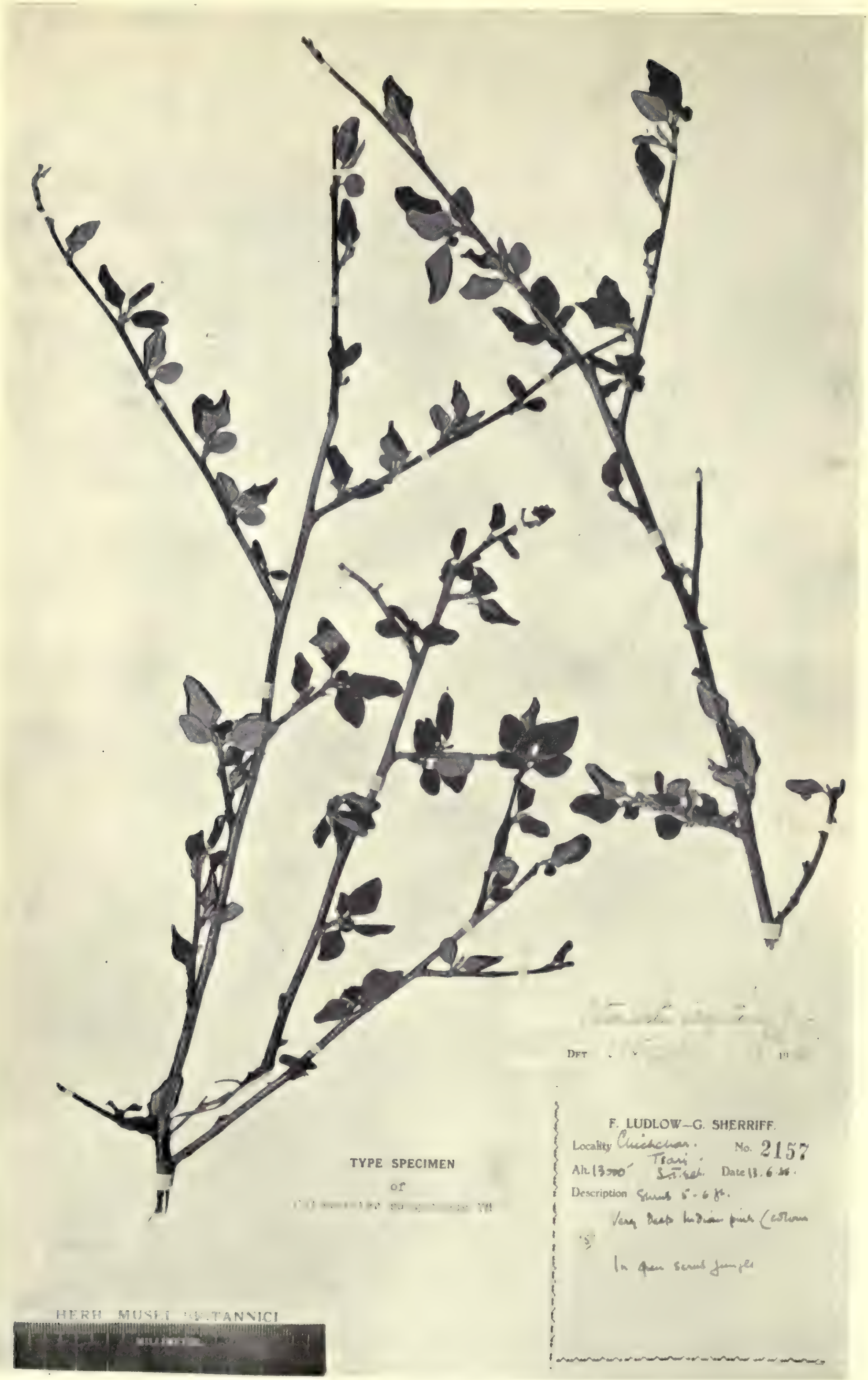
Locality Kongbo Nga La, Tsangpo Valley.
Lat. N. 29 02' Long. E. 93 13'
Altitude 12,900ft. Date 13.5.1938
No. 4246
F. LUDLOW, G. SHERRIFF, & G. TAYLOR

Cotoneaster Taylorii sp. nov
Type!
DET T. T. Yü 7 195[illegible]

4246

Shrub or small tree of 10' - along strea
below Kongbo La, - calyx dark crimson,
lobes fringed with hairs - petals
dark red with white margin.

Type specimen of *Cotoneaster taylorii* Yü


TYPE SPECIMEN
of
HERB. MUSEI BRITANNICI
DET.

F. LUDLOW—G. SHERRIFF.
Locality Chickchar. Tsari. No. 2157
Alt. 13500' S.E. Tib. Date 13. 6. 36.
Description Shrub 5–6 ft.
Very Deep Indian pink (colour '5'
In open scrub jungle

Type specimen of *Cotoneaster sanguineus* Yü

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A LIST OF THE GOLD COAST PTERIDOPHYTA

C. D. ADAMS AND A. H. G. ALSTON

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 1 No. 6
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BY

C. D. ADAMS

AND xults

A. H. G. ALSTON

Pp. 143–185

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THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series, corresponding to the Departments of the Museum, and an Historical Series.*

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A LIST OF THE GOLD COAST PTERIDOPHYTA

By C. D. ADAMS *and* A. H. G. ALSTON

SINCE the University College of the Gold Coast came into existence in 1948 investigation of the flora and natural vegetation of the country has been carried out with the intention of producing a Flora which would include the *Pteridophyta.*

In December 1949 it was arranged that the author resident in the Gold Coast should undertake the necessary collecting, herbarium curating, and recording of field observations of the *Pteridophyta.* Professor A. S. Boughey lent much practical assistance and encouragement; he and the University College of the Gold Coast provided travel facilities, within and outside the Gold Coast, without which this work would have not have been possible.

In the course of field work many Gold Coast people, too numerous to mention individually, have given their help, but special gratitude is due to Nana Ofori Atta II, Omanhene of Akyem Abuakwa State, for agreeing to preserve the Puso Puso ravine for botanical studies, and to all the collectors, past and present, who have contributed to our knowledge.

In April 1950 the author on the staff of the British Museum (Natural History) consented to undertake identifications and critical taxonomic examinations. The greater part of the taxonomic work has been carried out in the Museum. The writers express gratitude to the Keeper of Botany for his advice and help in preparing the manuscript for publication as well as for the facilities provided.

Thanks are also due to the Director of the Royal Botanic Gardens, Kew, for permitting the use of the Kew Herbarium collections and to Mr. F. Ballard for his cooperation. Gratitude is also extended to Dr. O. Hagerup of the Universitetets Botaniske Museum, Copenhagen, for the loan of valuable specimens from Thonning's collections.

This List is, as far as possible, an up-to-date statement of the taxonomy, nomenclature, and broad distribution of most of the indigenous Gold Coast *Pteridophyta.*

The habitat notes are the result of field observations of the living plants in many parts of the Gold Coast and in neighbouring countries, combined with summaries of collectors' annotations. They are intended to be descriptive rather than ecological as the definition of some of the smaller vegetation units is still uncertain. For similar reasons many altitude records have been omitted.

DISTRIBUTION

The geographical arrangement of the specimens in the List is in accordance with political areas shown by the boundaries on the Gold Coast Survey 1:1,000,000 Map, 8th edition, corrected 1947.

The primary division is into Colony, Southern Togoland, Ashanti and Northern Territories (including the northern part of Togoland under British Trusteeship).

The Colony is subdivided into Western and Eastern Provinces each of which has four Administrative Districts, the smaller Accra and Akwapim–New Juaben Districts being considered together as one unit, as also are Ada and Keta, as follows:

COLONY. *Western Province*

I. Ahanta–Nzima (SW.)
II. Wasaw–Aowin (W. and Central)
III. Sefwi (NW.)
IV. Cape Coast (E. and Central)

COLONY. *Eastern Province*

I. Birim (N.)
II. Accra and Akwapim–New Juaben (S.)
III. Volta River (E.)
IV. Ada and Keta (SE.)

The remaining Colonial Regions are divided into Districts as follows:

SOUTHERN TOGOLAND

I. Ho (S.)
II. Krachi (N.)

ASHANTI

I. Wenchi–Sunyani (NW.)
II. Kumasi (W. and Central)
III. Bekwai (S.)
IV. Mampong (NE.)

NORTHERN TERRITORIES

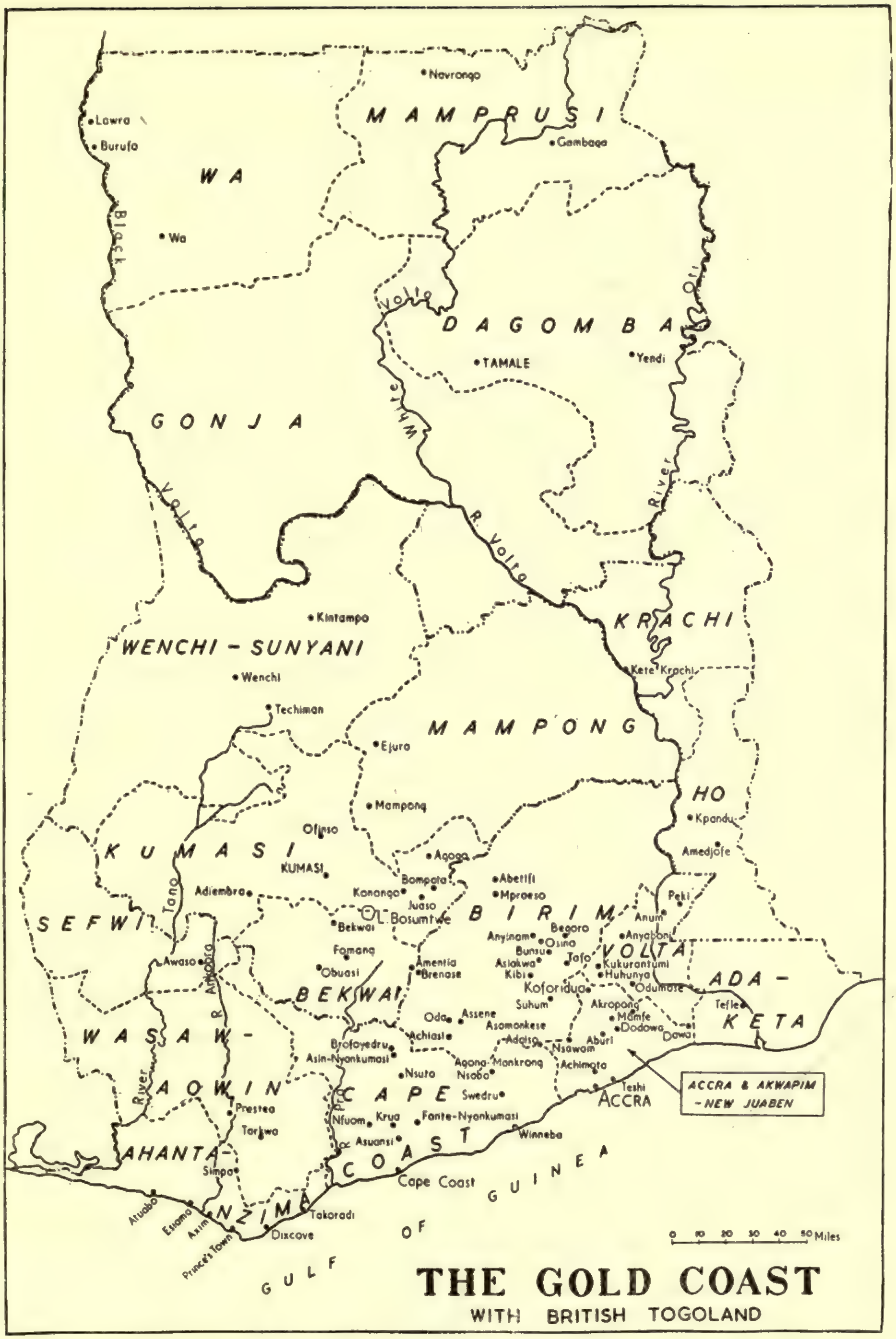
I. Gonja (SW.)
II. Dagomba (SE.)
III. Wa (NW.)
IV. Mamprusi (NE.)

The approximate position of the District within each Province or Colonial Region is indicated in brackets.

The spelling of place-names is taken mostly from the same map.

The Districts vary greatly in size and also bear little relation to the distribution of the natural vegetation or to the topography. They are adopted purely for convenience. On the other hand, the distribution of the plants mentioned in this list is closely associated with that of the phanerogamic flora in local ecological units.

There are certain large formations which must be recognized. The whole of the Northern Territories, north Ashanti, particularly Mampong District, the part of Birim District north of the Afram River together with most of the Krachi District of Southern Togoland constitute savannah country of which the greater part is Guinea Savannah. This formation also extends along the lower Volta and abuts on to the Accra Plains. This is a region of low rainfall stretching from Takoradi in the west to the Volta in the east and reaching inland from the coast to varying depths



Navrongo
MAMPRUSI
Gambaga
Lawra
Burufo
WA
Wa
Black
Volta
DAGOMBA
TAMALE
Yendi
Oti
GONJA
White
Volta
River
R. Volta
KRACHI
Kintampo
WENCHI - SUNYANI
Wenchi
Kete Krachi
Techiman
MAMPONG
Ejura
HO
Mampong
Kpandu
Amedjofe
Ofinso
KUMASI
KUMASI
Agogo
Bompata
Abetifi
Mpraeso
Adiembra
Konongo
Juaso
Peki
Tano
L. Bosumtwe
BIRIM
Anum
SEFWI
Bekwai
Begoro
Anyinam
Osino
Anyaboni
Fomang
Bunsu
Tafo
VOLTA
Awaso
Amentia
Asiakwa
Kukurantumi
Ankobra
Obuasi
Brenase
Kibi
Huhunya
ADA -
BEKWAI
Koforidua
Odumase
Suhum
Akropong
Tefle
WASSAW -
Oda
Assene
Mamfe
Asomonkese
Dodowa
KETA
Achiasi
Adoso
Aburi
Dawa
Brofoyedru
Nsawam
Asin-Nyankumasi
Agona
Mankrong
Achimota
Nsaba
AOWIN
Nsuta
Teshi
River
CAPE
Swedru
ACCRA
Prestea
Pra
ACCRA & AKWAPIM - NEW JUABEN
Nfuom
Krua
Fante-Nyankumasi
Tarkwa
Asuansi
Winneba
AHANTA -
COAST
Simpa
Cape Coast
GUINEA
Atuabo
Esiama
Axim
NZIMA
Takoradi
Prince's Town
Dixcove
OF
GULF
0 10 20 30 40 50 Miles
THE GOLD COAST
WITH BRITISH TOGOLAND

MAP OF THE GOLD COAST

— · · — = Boundaries of Colonial Regions, i.e. the Colony proper, Southern Togoland, Ashanti and Northern Territories. The Colony is divided into Western and Eastern Provinces. – – – – = Boundaries of Districts.

of up to twenty miles. *Pteridophyta* are very poorly represented in savannah country and include only such plants as show a geophytic habit, e.g. *Ophioglossum* spp., or are aquatic annuals, e.g. *Marsilea* spp., *Azolla africana* and *Salvinia nymphellula*. The records of *Adiantum philippense* and *Nephrolepis undulata* from the Northern Territories indicate a more northerly distribution for these two species than is the case for other ferns listed.

The rest of the country, i.e. most of Ashanti, the Colony and the Togoland hills, is covered with forest. This forest is subject for the most part to double-maximum rainfall with the total rainfall diminishing from the south-west towards the north-east. Included here are isolated areas with higher rainfall such as the Atewa range and the Togo Plateau. The forest referred to in the list as 'wet' is that of the south-west, and those isolated areas where the rainfall exceeds 70 inches; it is to be understood that wet conditions may occur locally near rivers, streams and swamps in other parts of the forest. The topography of the forest country also changes from the south-west towards the north-east in that the land becomes more hilly and rises to greater elevations until the scarp country is reached. Sandstone scarps extend south-eastwards from Wenchi, Mampong (Ashanti) and Kwahu to the Volta with, from there, a south-westerly arm, the Akwapim ridge. The forest cover of this higher ground is of a distinct type and is referred to descriptively as 'dry'. Much of the Togoland highlands support the same type of forest.

Some areas have been very thoroughly studied, but for much of the country records are few or altogether lacking. Further collections are needed especially from western and north-western Ashanti, Sefwi District of the Colony, the Mampong and Kwahu scarp country and the transitional forest to the north of it, as well as from the more northerly parts of the Togo highlands.

Notes on three of the better-known areas follow.

Collections in the Axim District (Ahanta–Nzima) and near Tarkwa and Prestea (Wasaw–Aowin) have been made by Burton and Cameron, W. H. Johnson, F. R. Irvine, P. Cudjoe and others. This is the part of the Gold Coast forest which has been termed Evergreen. Fifty-four species are recorded from this area and of these eighteen are at present not known from the adjoining Cape Coast District to the east, including two species, *Tectaria buchholzii* and *Schizoloma ensifolium*, which are confined to the western region. Scandent sun-ferns are conspicuous in secondary formations and along roadsides. Many otherwise common terrestrial and high-level epiphytic species seem to be uncommon or rare. *Asplenium* species are notably few.

Extensive collections have been made by H. E. Box and J. Scholes in the Cape Coast District, especially at Asuansi and in the Kakum and Foso–Juaso Forest Reserves (the latter now being known as Ochi Headwaters Forest Reserve). Fifty-five species are recorded from this area, representing most of the common terrestrial forest ferns and high-level epiphytes as well as many species restricted to swampy areas and forest streams. No species is exclusive to this area which includes several aspects of the low-altitude natural forest and much secondary vegetation.

Small areas of the Atewa range have been more intensively studied than any other region. This range of hills with an area of over 140 square miles above 1,000 feet, and rising to about 2,500 feet, is situated in Birim District of Eastern Province with

Kibi near its centre. Cocoa farms are frequent up to 1,000 feet and above that plantain, banana and coco-yam (*Xanthosoma sagittifolium*) are sporadically cultivated. Most of the area is inaccessible by roads or paths and in many places forest apparently not significantly altered by man exists. The annual rainfall is high, 80 inches or over, but varies locally. Permanent streams exist which feed the Birim, Ayensu and Densu Rivers, the only south-flowing rivers of any magnitude arising in the Eastern Province. The sources of these three rivers lie within three miles of each other in the centre of the range. Cloud often forms in the afternoon and showers and thunderstorms are frequent, while mists may not disperse in the morning until up to four hours after sunrise. The result of such topographic and climatic conditions is constant high humidity, especially in steep-sided sheltered valleys such as the Puso Puso ravine where even in the dry season the Harmattan has little noticeable effect.

Although W. H. Johnson and F. R. Irvine collected in the neighbourhood of Kibi the richness of the pteridophyte flora of the Atewa range was not properly revealed until Box and Scholes visited the area in 1941–1943. Out of 114 strictly forest species known in the Gold Coast 78 are recorded from this area including such nearby places as Anyinam, Apapam, Asiakwa, Awaham, Bunsu, Osino and Potroasi; while from the Puso Puso ravine, which lies in the part of the range nearest to Asiakwa in the north-east, 62 species occur in an area less than one square mile in extent. Of the species known from the range 9 are unrecorded elsewhere and 5 from the Puso Puso ravine only.

Certain species such as *Cyathea camerooniana* and *Bolbitis fluviatilis* seem, as far as is known, to be confined to the Atewa range and the south-western forest. Several other species are common in these two areas and rather rare elsewhere, e.g. *Pteris burtoni*, *Lomariopsis* spp. and *Lygodium smithianum*.

Records are insufficient for reliable comparisons to be drawn between other areas, but affinities between the Atewa range and the drier forest of the scarp and between each of these and the Togo highlands can be recognized. For example Begoro and Bosuso are situated on the scarps to the north of the Atewa range. Certain rare species are so far recorded only from the Begoro area and the Atewa range, e.g. *Cyathea manniana*, *Asplenium cuneatum*, *A. geppii*, *A. diplazisorum* and *Loxogramme latifolia*. The soils of the scarp are sandy and quite unlike the deep sticky clay soils of the Atewa range. Climatic conditions may be similar in the Begoro area to those of the range, but few of the streams have any high degree of permanence.

In addition there is a distinctive fern flora of the marginal forest zone which is transitional to savannah. The limits of this flora are not fully known, but the characteristic species of it include those mentioned in the note after *Asplenium emarginatum*.

Much remains to be discovered before a full understanding of the distribution of these plants is reached; many of the correlations already made are empirical. Of perhaps the greatest phytogeographical importance is the comparison which remains to be made in detail between the flora of the Atewa range and that of the mountains of West Africa where considerable similarities are already apparent.

Finally it is perhaps worth pointing out, without comment at present, the almost total absence of endemic species

CLASSIFICATION

The classification of R. E. Holttum (in Journ. Linn. Soc. Lond., Bot. liii: 123–158 (1947)) has been adopted in the Systematic List for the Leptosporangiate Ferns.

Holttum has recognized the subdivision of the large genera *Polypodium* and *Dryopteris*, which, *sensu strictò*, are not found in the Gold Coast but are represented by the segregates *Microgramma*, *Microsorium* and *Phymatodes* in the former case, and by *Cyclosorus*, *Thelypteris* and *Ctenitis* in the latter. Some of the resulting new combinations for African species have already been made by Copeland, Ching and Tardieu–Blot in recent publications; others appear for the first time here.

The genus *Diplazium* is retained as representing a clear-cut group in the Gold Coast but is less certainly distinct from *Athyrium* when compared with the members of the latter genus from the mountains of West Africa.

The genus *Trichomanes* has not been subdivided, mainly on account of the doubtful practical value of splitting up the small number of species, most of which are rare, represented in the country. That is not to say that our species are uniform in character; on the contrary they would fall into four of Copeland's genera (E. B. Copeland in Philipp. Journ. Sci. lxvii : 1–110 (1938)).

SYSTEMATIC LIST

The *Pteridophyta* included in this list are considered to be either indigenous or fully naturalized.

Only the synonymy which refers directly to the currently accepted name, or has been published in connexion with a Gold Coast plant, has been included.

Abbreviations employed for herbaria in the list are as follows:

> B=Botanical Museum, Berlin-Dahlem. BM=British Museum (Natural History), London. C=Universitetets Botaniske Museum, Copenhagen. FHI=Forestry Department, Ibadan, Nigeria. FHK=Forestry Department, Kumasi, Gold Coast. FI=University of Florence. GC=Gold Coast Herbarium, University College of the Gold Coast. IFAN=Institut Français d'Afrique Noire, Dakar. K=Royal Botanic Gardens, Kew. P=Muséum National d'Histoire naturelle, Paris. US=Smithsonian Institution, Washington.

The abbreviation F.R. is used for Forest Reserve.

FILICINAE

OPHIOGLOSSACEAE

OPHIOGLOSSUM L.

Ophioglossum ammophilum C. D. Adams in Ann. & Mag. Nat. Hist., Ser. 12, vii: 874 (1954).

COLONY. *Eastern Province*: II. 17 km. on Accra–Ada road, *Adams 2341A* (GC). Near Kpeshi Lagoon, near Labadi, *Adams 2353* (GC), *2726* (BM; GC Type).

In open sandy grassland near the sea

Ophioglossum costatum R.Br., Prodr. Fl. Nov. Holl. i: 163 (1810).

Ophioglossum fibrosum (Schumach.) in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 226 (1829).—Kuhn, Fil. Afr.: 176 (1868).

COLONY. *Western Province*: I. Frederiksberg, *Thonning* (ex Schumach.). IV. Winneba plains, *Hinds GC 2499* (GC). *Eastern Province*: II. Near Kpeshi Lagoon, near Labadi, *Adams 341* (BM; GC; K), *2725* (GC). 59 km. on Accra–Ada road, *Akpabla GC 2186* (GC).

ASHANTI. I. Half-way between Wenchi and Techiman, *Cudjoe 101* (GC).

NORTHERN TERRITORIES. III. Near Wa, *Adams 706* (GC; P), *869* (GC). Burufu, near Lawra, *Adams 930* (GC; US). IV. Navrongo, *Vigne 4608* (K). Jawani, near Gambaga, *Akpabla 667* (GC). West of Gambaga, *Morton GC 7455* (GC).

Local in silted depressions in grass savannah.

Ophioglossum gomezianum Welw. ex A.Br. apud Kuhn, Fil. Afr. : 176 (1868).

Var. **gomezianum.**

COLONY. *Western Province*: IV. Winneba plains, *Adams 308* (BM; GC). *Eastern Province*: II. 17 km. on Accra–Ada road, *Adams 2341* (GC). Near Kpeshi Lagoon, near Labadi, *Adams 2355* (GC), *2724* (BM; GC).

In open grassland.

Var. **latifolium** Prantl in Jahrb. Bot. Gard. Berl. iii: 316 (1884).

COLONY. *Eastern Province*: I. Pepiase, Kwahu, *Morton GC 4597* (BM; GC).

In black silty soil overlying rock.

Prantl in his diagnosis of this variety states 'sporae degenerae'. This is of great interest in that the spores of our material, unlike those of any other Gold Coast species which have been examined, appear to lack cytoplasmic contents entirely.

Ophioglossum gramineum Willd., Nov. Act. Acad. Erfurt ii: 18 (1802).

ASHANTI. IV. Near Ejura, *Morton GC 9828* (GC).

In savannah grassland.

Ophioglossum macrorrhizum Kunze, Anal. Pterid.: 2 (1837).—Die Farnkräuter i: 57, t. 29, f. 1 (1840).

COLONY. *Eastern Province*: II. Near Kpeshi Lagoon, near Labadi, *Adams 2748* (GC).

In open sandy grassland near the sea.

Ophioglossum reticulatum L., Sp. Pl. ii: 1063 (1753).

COLONY. *Western Province*: I. Axim–Sekondi road, *Morton A396* (GC), *Cudjoe 129* (GC), *130* (GC). II. Tarkwa, *Fishlock 120* (GC). IV. Cape Coast, *Don* (BM). Asuansi, *Box 2053* (BM; GC), *Scholes 170* (GC; IFAN; K; P; US), *Vaughan GC 2722* (GC).

Locally abundant in sandy soil in wet areas.

MARATTIACEAE

MARATTIA Sw.

Marattia fraxinea Sm., Pl. Ic. Hact. Ined. ii: t. 48 (1790).—Chipp, List Herb. Pl. G. C.: 40 (1914).—Irvine, Pl. G.C.: 277 (1930).

COLONY. *Western Province*: I. Basakeh, near Axim, *Cudjoe 15* (GC). II. Dompem, *Chipp 47* (FHK; K). Near Tarkwa, *Fishlock 88* (GC; K). Opon valley, *Irvine 1302* (GC; K). Neung F.R., near Tarkwa, *Cudjoe 5* (GC; K; P). III. Awaso F.R., *Akpabla 874* (GC). IV. Kakum F.R., near Nfuom, *Box 2850* (BM; GC), *2936* (BM; GC). *Eastern Province*: I. Pami Bepo, Kibi, *Chipp 540* (FHK; GC; K). Atewa range F.R., near Kibi, *Irvine 3025* (GC). Puso Puso ravine, Atewa range, *Box 3262* (BM), *3462* (BM); *Scholes 448* (GC; BM); *Adams 325* (GC), *339* (GC). Potroasi, near Kibi, *Adams 153* (GC). Bunsu, *Cudjoe 79* (GC).

ASHANTI. II. Bompata, *Vigne 2715* (FHK; GC; K). Tano–Ofin F.R., *Vigne 2880* (FHK; K).

Locally abundant in the wet forest especially near permanent streams.

SCHIZAEACEAE

LYGODIUM Sw.

Lygodium microphyllum (Cav.) R.Br., Prodr. Fl. Nov. Holl. i: 162 (1810).

Ugena microphylla Cav., Ic. & Descr. Pl.: 76, t. 595, fig. 2 (1801).
Lygodium scandens sensu Chipp, List Herb. Pl. G.C.: 40 (1914); non Sw.

COLONY. *Western Province*: I. Axim, *Johnson 997* (GC; K); *Irvine 2144* (GC; K); *Cudjoe 73* (GC; P; US); *Morton* (GC). Near Esiama, *Fishlock* (GC); *Deakin 148* (GC; K). Brawile, near Axim, *Cudjoe 48* (GC; K). II. Simpa, *Vigne 2912* (FHK; GC; K). *Eastern Province*. I. Anyinam, *Obeng 13* (GC; K).

ASHANTI. II. Bantama, near Kumasi, *Box 2907* (BM; GC).

Occasional on roadside embankments, railway cuttings, and in clearings in the areas of highest rainfall.

This is the species usually known as *L. scandens* (L.) Sw., but the type specimen of *L. scandens* (in Herb. Hermann, vol. i: fol. 32, no. 374, at the British Museum) is not *L. microphyllum* but *L. flexuosum* (L.) Sw., of which *L. scandens* should be regarded as a synonym.

Lygodium smithianum C. Presl, Suppl. Pterid.: 112 (1845).

Lygodium pinnatifidum sensu Chipp, List Herb. Pl. G.C.: 40 (1914).—Oliv. in Burton & Cameron, To the G.C. for Gold ii: 371 (1883); non Sw.

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K). Axim, *Chipp 416* (FHK; K); *Foote 125* (GC). Near Agona, Dixcove road, *Box 2075* (GC). II. Bonsa junction, *Johnson 862* (GC; K). Hemang, *Fishlock 36* (K). Tarkwa, *Vigne 4124* (FHK; GC). III. Awaso F.R.? *Akpabla 888* (GC). IV. Asuansi, *Box 2042* (BM; GC), *2047* (BM; GC); *Scholes 229* (GC). Foso–Juaso F.R., *Scholes 239* (GC). *Eastern Province*: I. Begoro, *Irvine 1367* (GC). Puso Puso ravine, Atewa range, *Adams 36* (GC). Potroasi, near Kibi, *Adams 162* (GC; K), *394* (GC). Near Apapam, near Kibi, *Adams 971* (GC; P; US).

ASHANTI. III. Near Fomena, *Adams 2505* (GC).

Occasional on roadside embankments, railway cuttings and in clearings in the areas of highest rainfall.

GLEICHENIACEAE

GLEICHENIA Sm.

Gleichenia linearis (Burm. f.) C. B. Clarke in Trans. Linn. Soc. Lond., Ser. 2, Bot. i: 428 (1880).

Polypodium lineare Burm. f., Fl. Ind.: 235 (1768).
Dicranopteris linearis (Burm. f.) Underw. in Bull. Torr. Bot. Club xxxix: 250 (1907).

COLONY. *Western Province*: I. Axim, *Irvine 2147* (GC; K). Abra, near Axim, *Box 2870* (GC). Axim–Agona junction road, *Cudjoe 53* (GC). II. Tarkwa, *Vigne 4120* (FHK; GC). *Eastern Province*: I. Puso Puso ravine, Atewa range, *Adams 37* (GC), *510* (BM; GC; K; P; US). Potroasi, near Kibi, *Adams 164* (GC), *575* (GC).

ASHANTI. II. Merishe, near Adiembra, *Kitson 1223* (K).

Habitat similar to that of the last species.

HYMENOPHYLLACEAE

TRICHOMANES L.

Trichomanes africanum Christ in Journ. de Bot. xxii: 21 (1909).

COLONY. *Eastern Province*: I. Atewa range, *Box 3503* (BM); *Adams 1445* (GC). *Western Province*: III. Awaso, *Adams 2073* (GC).

SOUTHERN TOGOLAND. I. Avatime mount, 750 m., *Johnson* (coll. *Dr. Fisch*) *747* (K); Waribo Mountain, north of Wurupong, *Adams 1817* (GC), *1826* (BM; GC; FI).

On mossy branches of shrubs and small trees in virgin mountain forest. Apparently rare.

The dried fronds lack the folds which are apparent in *T. melanotrichum* Schlecht.

Trichomanes chamaedrys Taton in Bull. Soc. R. Bot. Belg. lxxviii: 29, t. 2 figs. K, L (1946).

COLONY. *Eastern Province*: I. Near Akrum Waterfall, Begoro, *Box 2948* (BM; GC). *Western Province*: III. Afao Hills F.R., *Adams 2066* (BM; GC).

On shady precipice walls and on trees in mountain forest at 510 m. altitude.

Trichomanes chevalieri Christ apud A. Chev. in Mém. Soc. Bot. France ii, 8: 106 (1908).

COLONY. *Eastern Province*: I. Awaham, near Asamankese, *Adams 521* (GC). Puso Puso ravine, Atewa range, *Adams 573* (GC). II. Aburi, *Johnson* (K); *Adams 402* (GC). III. Bana Hill, Krobo, *Irvine 2882* (BM; GC). Volta River F.R., *Adams 377* (BM; GC; P; US), *484* (GC).

Epiphytic on trees and on rocks mainly in the dry forest areas.

Trichomanes cupressoides Desv. in Mém. Soc. Linn. Par. vi: 330 (1827).

COLONY. *Eastern Province*: I. Puso Puso ravine, Atewa range, *Box 3265* (BM; GC); *Scholes 444* (GC); *Adams 35* (GC), *340* (BM; GC), *504* (GC), *569* (GC; K; P; US). Atewa range, *Box 3501* (BM; GC). Near Kibi, *Adams 1202* (GC).

Local on steep clay banks in deep shade.

Trichomanes erosum Willd. in L., Sp. Pl., ed. 4, v: 501 (1810).

Trichomanes muscoides sensu Chipp, List Herb. Pl. G.C.: 40 (1914): non Sw.

COLONY. *Western Province*: I. Ancobra River, *Johnson 986* (K). IV. Asuansi, *Box 2081* (BM), *2094* (BM), *2480* (BM; GC). Kakum F.R., near Nfuom, *Box 2856* (BM; GC), *2933* (BM; GC). *Eastern Province*: I. Abetifi Hills, *Johnson 653* (K, not seen). Near Asiakwa, *Adams 201* (GC). Puso Puso ravine, Atewa range, *Box 3266* (BM; GC); *Adams 419* (GC; K), *495* (GC; P; US).

SOUTHERN TOGOLAND. I. Togo Plateau F.R., *Morton GC 3803* (GC).

ASHANTI. II. Agogo, *Adams 2631* (GC).

Frequent on rocks and trees near streams in the wet forest.

Trichomanes guineense Afz. ex Sw. in Schrad., Journ. Bot. 1800, 2: 96 (1801).

Trichomanes rigidum sensu Chipp, List Herb. Pl. G.C.: 40 (1914); non Sw.

COLONY. *Western Province*: I. Ancobra River and Bonsa junction, *Johnson 861* (K). Near Axim, *Irvine 2246* (K). Mielialuma, Basakeh, near Axim, *Cudjoe 60* (GC; P; US). II. Neung F.R., near Tarkwa, *Cudjoe 37* (BM; GC; K). IV. Kakum F.R., near Nfuom, *Box 2934* (BM; GC). *Eastern Province*: I. Near Kibi, *Adams 1203* (GC).

Terrestrial on wet clay or silt in deep shade. Rather local.

Trichomanes liberiense Copel. in Philipp. Journ. Sci. li: 160 (1933).

COLONY. *Eastern Province*: I. Puso Puso ravine, Atewa range, *Adams 1193* (BM; GC).

Epiphytic on the trunk of a small tree near rocky stream at 390 m. altitude.

Trichomanes mettenii C. Chr., Ind. Fil.: 644 (1906).

COLONY. *Western Province*: IV. Asuansi, *Box 2481* (GC; BM); *Scholes 183A* (GC), *185* (GC). Kakum F.R., near Nfuom, *Box 2918* (BM; GC). *Eastern Province*: I. Near Begoro, *Adams 255* (BM; GC). Puso Puso ravine, Atewa range, *Adams 1192* (GC). Near Chapiasi, near Kibi, *Adams 1198* (GC). III. Near Otrokpe, *Adams 562* (GC; K; P; US).

ASHANTI. III. Near Fomena, *Adams 2521* (GC).

Epiphytic on tree-trunks and on rocks near streams in the forest.

CYATHEACEAE

CYATHEA Sm.

Cyathea camerooniana Hook. in Hook. & Bak., Synops. Fil.: 21 (1865).

COLONY. *Western Province*: I. Near Basakeh, near Axim, *Cudjoe 20* (GC; K; P; US), *66* (GC). II. Tarkwa–Dompem–Simpa road, *Fishlock 1* (K). Prestea, *Vigne 3088*

(FHK; GC; K). III. Awaso F.R., *Akpabla 876* (GC). Awaso, *Darko 31* (BM). *Eastern Province*: I. Puso Puso ravine, Atewa range, *Box 3273* (BM; GC); *Scholes 438* (GC; BM); *Adams 78* (GC), *324* (BM; GC).

ASHANTI. II. Tano–Ofin F.R., *Vigne* (*coll. Lyon 116*) *2876* (FHK K).

Rather local on hillsides near streams in the wet forest.

Cyathea manniana Hook. in Hook. & Bak., Synops. Fil.: 21 (1865).

COLONY. *Eastern Province*: I. Puso Puso ravine, Atewa range, *Box 3272* (BM; GC); *Scholes 437* (BM; GC; K); *Adams 77* (GC), *576* (GC; P; US). Begoro, *Box 3472* (BM; GC).

Very local and gregarious near streams in hilly districts.

POLYPODIACEAE

PLATYCERIUM Desv.

Platycerium angolense Welw. ex Hook. & Bak., Synops. Fil.: 425 (1868).

ASHANTI. II. Agogo, *Foote 52* (GC). Bobiri F.R., *Adams 538* (GC; K; P; US). IV. Mampong, *Adams & Akpabla 4526* (BM; GC).

On the branches of tall trees in the forest; very rarely on rocks.

Platycerium stemaria (Beauv.) Desv. in Mém. Soc. Linn. Par. vi: 213 (1827).—Cummins in Bull. Misc. Inf. Kew 1898: 82 (1898).

Acrostichum stemaria Beauv., Fl. Oware & Benin i: 2, t. 2 (1805).

COLONY. *Western Province*: IV. Nsuta, *Cummins 49* (K). Asuansi, *Box 2058* (BM; GC). *Eastern Province*: I. Potroasi, near Kibi, *Adams 167* (GC). II. Aburi, *Irvine 61* (GC). III. Volta River F.R., near Odumase, *Adams 994* (GC; P; US).

Epiphytic on the branches of trees in the forest; frequent in the juvenile state on the trunks and low branches of small trees, especially cocoa. More common in the eastern part of the forest than *P. angolense*.

MICROGRAMMA C. Presl

Microgramma lycopodioides (L.) Copel., Gen. Fil.: 185 (1947).

Polypodium lycopodioides L., Sp. Pl. ii: 1082 (1753).
Polypodium owariense Desv. in Mag. Ges. Naturforsch. Freunde Berl. v: 314 (1811).

COLONY. *Western Province*: I. Gyamera, near Axim, *Irvine 2305* (GC; K). Near Axim, *Irvine 2423* (GC). IV. Asuansi, *Box 2038* (BM; GC); *Adams 488* (GC). *Eastern Province*. I. Anyinam, *Obeng 8* (GC). Bunsu, *Gillett 155* (BM). Potroasi, near Kibi, *Adams 172* (GC). Near Asiakwa, *Adams 195* (GC). II. Aburi, *Johnson 208* (GC); *Howes 1190* (GC; K); *Irvine* (GC); *Adams 34* (GC), *176* (GC; K), *184* (GC). Mampong hill, Akwapim, *Todd* (GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Box 3432* (BM).

ASHANTI. II. Near Kumasi, *Vigne 3047* (FHK; GC; K).

A common epiphyte on trees, rarely on rocks, throughout the forest area.

MICROSORIUM Link

Microsorium punctatum (L.) Copel. in Univ. Calif. Publ. Bot. xvi: 111 (1929).

Acrostichum punctatum L., Sp. Pl., ed. 2, ii: 1524 (1763).
Polypodium punctatum (L.) Sw. in Schrad., Journ. Bot. 1800, 2: 21 (1801); non *P. punctatum* Thunb. (1784).—Kuhn, Fil. Afr.: 151 (1868).—Irvine, Pl. G.C.: 350 (1930).
Polypodium crassinerve Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 227 (1829); non *P. crassinerve* Bl. (1828).

COLONY. *Western Province*: IV. Asuansi, *Box 2046* (BM; GC), *2096* (BM; GC). *Eastern Province*: I. Assene, *Foote 130* (GC). II. Akwapim, *Thonning 87* (C). Aburi, *Deighton 631* (K); *Obeng 3* (GC); *Adams 211* (GC). Achimota (cultivated), *Irvine 2591* (GC). III. Volta River F.R., *Adams 381* (GC).

ASHANTI. II. Agogo, *Foote 12* (GC).

WITHOUT LOCALITY. *Irvine 471* (GC; K).

A common epiphyte on trees and sometimes on rocks in the forest.

DRYNARIA (Bory) J.Sm.

Drynaria laurentii (Christ) Hieron. apud Engl. in Engl. & Drude, Veg. Erde ix, 2: 57 (1908), excl. fig. 54.

Polypodium propinquum var. *laurentii* Christ apud De Wild. in Ann. Mus. Congo, Bot. Sér. 5, i: 6, t. 2 (1903).
Polypodium willdenowii sensu Chipp, List Herb. Pl. G.C.: 40 (1914); non Bory.

COLONY. *Eastern Province*: I. Pami Bepo, near Kibi, *Chipp 555* (FHK; GC; K). Begoro, *Irvine 1177* (GC); *Adams 422* (GC; P; US). Puso Puso ravine, Atewa range, *Box 3274* (BM); *Adams 500* (GC). Near Apapam, near Kibi, *Adams 975* (GC; P; US).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3388* (GC); *Box 3435* (BM; GC).

ASHANTI. II. Agogo, *Darko* (GC).

Occasional as an epiphyte on trees at elevations above 300 m.

PHYMATODES C. Presl

Phymatodes scolopendria (Burm. f.) Ching in Contrib. Inst. Bot. Nat. Acad. Peiping ii: 63 (1933).

Polypodium scolopendria Burm. f., Fl. Ind.: 232 (1768).
Polypodium phymatodes L., Mant. Pl. Alt.: 306 (1771).—Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898).—Chipp, List Herb. Pl. G.C.: 40 (1914).

COLONY. *Western Province*: I. River Nhwini, near Takoradi, *Box 2077* (BM; GC). Brawile, near Axim, *Cudjoe 33* (GC). IV. Without locality, *Cummins* (K). Asuansi, *Box 2037* (BM; GC), *2060* (BM; GC), *2071* (BM; GC); *Adams 490* (GC). *Eastern Province*: I. Wankyi, *Chipp 562* (FHK; K). Abetifi, *Plumptre 203* (GC). Assene, *Foote 132* (GC). Kukna, *Bekoe* (GC). Potroasi, near Kibi, *Adams 170* (GC). Apapam, near Kibi, *Adams 976* (GC). II. Aburi, *Johnson 209* (GC); *Obeng 7* (GC; K); *Box 2088* (BM; GC); *Adams 31* (GC; K), *399* (GC).

ASHANTI. II. Bompata, *Vigne 2720* (FHK; K). Kumasi, *Vigne 3050* (FHK; K); *Onyeama 56* (GC). Agogo, *Foote 99* (BM; GC), *101* (GC).

A very common epiphyte on trees, especially on mature oil-palms, in the forest.

LOXOGRAMME (Bl.) C. Presl

Loxogramme lanceolata (Sw.) C. Presl, Tent. Pterid.: 215, t. 9, fig. 8 (1836).

Grammitis lanceolata Sw. in Schrad., Journ. Bot. 1800, 2: 18 (1801).

Gymnogramme lanceolata (Sw.) Hook., Sp. Fil. v: 156 (1864).—Chipp, List Herb. Pl. G.C.: 40 (1914).

COLONY *Western Province*: III. Afao Hills F.R., *Adams 1962* (GC), *2048* (GC). *Eastern Province*: I. Near Begoro, *Adams 460* (GC). II. Akropong, Akwapim, *Johnson 992* (GC; K). Aburi, *Adams 400* (BM; GC; K; P; US), *401* (GC), *988* (GC). Aburi ?, *Johnson 212* (GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3399* (GC); *Box 3431* (BM; GC).

ASHANTI. N. Ashanti, without locality, *Dalziel 75* (K).

An epiphyte on the low branches and trunks of trees and on palms in the dry forest at elevations above 300 m. altitude. Local.

Loxogramme latifolia Bonap., Not. Ptérid. xiv: 334 (1924).

COLONY. *Eastern Province*: I. Near Begoro, *Adams 459* (BM; GC). Apapam, near Kibi, *Adams 970* (BM; GC; P; US).

On the branches of small trees in hilly districts above 300 m. altitude. Rare.

THELYPTERIDACEAE

CYCLOSORUS Link

Cyclosorus dentatus (Forsk.) Ching in Bull. Fan Mem. Inst. Biol. viii: 206 (1938).

Polypodium dentatum Forsk., Fl. Aegypt.- arab.: cxxv, 185 (1775).

COLONY. *Western Province*: I. Near Axim, *Cudjoe 7* (BM; GC). Agona junction–Dixcove road, *Cudjoe 51C* (GC). II. Mpeasem, Fure F.R., near Prestea, *Cudjoe 35* (BM; GC), *44* (BM; GC). IV. Agona–Mankrong, *Vanderpuye 5* (GC). *Eastern Province*. I. Puso Puso ravine, Atewa range, *Adams 317A* (GC), *496A* (GC). Near Suhum, *Adams 382* (BM; GC). Potroasi, near Kibi, *Adams 393A* (GC). III. Boti, near Huhunya, *Adams 281* (BM; GC). Near Ayemeso, Volta River F.R., *Adams 997* (GC).

ASHANTI. I. Fuller Falls, near Kintampo, *Adams 579* (GC). II. Lake Bosumtwe, *Adams & Akpabla 4539* (GC); *Adams 539* (GC; K; P; US). Bobiri F.R., *Adams 531* (GC). IV. Ejura scarp, *Adams & Akpabla 4523* (GC).

Widely distributed throughout the forest and transitional zones near unshaded streams, paths and roadsides.

Cyclosorus dewevrei (Christ ex Bonap.) Adams & Alston, comb. nov.

Nephrodium pennigerum sensu Oliv. in Burton & Cameron, To the G.C. for Gold ii: 371 (1883).—Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898).—Chipp, List Herb. Pl. G.C.: 40 (1914); non Hook.

Nephrodium truncatum sensu Cummins, loc. cit. (1898); non C. Presl.

Dryopteris afra Christ apud A. Chev. in Mém. Soc. Bot. France ii, 8: 107 (1908) pro parte.

Dryopteris dewevrei Christ ex Bonap., Not. Ptérid. xiv: 207 (1924).

Dryopteris megaphylla sensu Irvine, Pl. G.C. 169 (1930); non C. Chr.

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?) *Burton &*

Cameron (K). Benyimade, near Axim, *Cudjoe 8* (GC; K). II. Neung F.R., near Tarkwa, *Cudjoe 10* (GC). IV. Asin–Nyankumasi, *Cummins 183* (K); *215* (K). Asuansi, *Box 2043* (BM), *2059* (GC; BM), *2078* (GC; BM); *Adams 116* (GC). *Eastern Province*: I. Anyinam, *Obeng 12* (GC). Assene, *Foote 134* (GC). Bunsu, *Foote 110* (GC). Near Asiakwa, *Adams 83* (GC), *197* (GC). II. Aburi, *Obeng 12A* (GC). Akropong, Akwapim, *Irvine 2620* (GC).

SOUTHERN TOGOLAND. I. Buem, *Mischlich* (P).

ASHANTI. II. Merishe, near Adiembra, *Kitson 1224* (K). Bompata, *Vigne 2708* (FHK; K). III. Pra-Anum F.R., near Amentia, *Irvine 465* (GC; K).

WITHOUT LOCALITY. *Farmer 447, 448/557* (K).

Abundant in cleared areas, by roadsides and paths in the forest, and an almost constant feature of the field layer in cocoa farms.

Whilst the mature plant propagates rapidly by means of a long creeping and branching rhizome the juvenile states show approximate or even tufted fronds.

Cyclosorus microbasis (Bak.), Adams & Alston, comb. nov.

Nephrodium microbasis Bak. in Hook. & Bak., Synops. Fil.: 496 (1874).

ASHANTI. I. Techiman, *Adams & Akpabla 4494* (BM; GC).

In wet sandy soil near spring on hillside in the transitional forest zone; only once recorded.

The type specimen of this species has some united veins as in *Cyclosorus* and some free as in *Thelypteris*.

Cyclosorus costularis (Bak.) Adams & Alston, comb. nov.

Gymnogramme unita Kunze in Linnaea xviii: 115 (1844); non *Cyclosorus unitus* Ching (1932).

Goniopteris patens Fée, Mém. Fam. Foug. v: 253 (1852); non *Cyclosorus patens* Copel. (1947).

Goniopteris silvatica Pappe & Rawson, Synops. Fil. Afr. Austr.: 39 (1858), *nom. illegit.*

Nephrodium costulare Bak. in Journ. Linn. Soc. Bot. xvi: 203 (1877).

COLONY. *Eastern Province*: I. Puso Puso ravine, Atewa range, *Adams 403* (BM; GC), *501* (BM; GC). Apapam, near Kibi, *Adams 973* (GC).

Near permanent hill streams in the forest. Rather rare and so far recorded only from the one district.

Cyclosorus quadrangularis (Fée) Tard. in Notul. Syst. xiv: 345 (1952).

Nephrodium quadrangulare Fée, Mém. Fam. Foug. v: 308 (1852).

Nephrodium molle sensu Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898); non Desv.

COLONY. *Western Province*: I. Near Prince's Town, *Cudjoe 95* (GC). IV. Asuansi, *Box 2041* (BM; GC), *2057* (BM; GC). Jakai, *Box 2079* (BM). Kakum F.R., near Nfuom, *Box 2865* (BM; GC). Foso–Juaso F.R., *Scholes 252* (BM; GC). *Eastern Province*: I. Achiasi, near Oda, *Box 2888* (BM; GC). Puso Puso ravine, Atewa range, *Adams 317* (BM; GC), *496* (GC). Potroasi, near Kibi, *Adams 393* (BM; GC; K).

ASHANTI. II. Merishe, near Adiembra, *Kitson 1225* (K). Bompata, *Vigne 2703* (FHK). IV. Mampong, *Vigne 4102* (FHK; K).

WITHOUT LOCALITY. *Cummins 88* (K).

Occupying similar habitats to *C. dentatus* and frequently associated with it though less widely distributed.

Cyclosorus striatus (Schumach.) Copel., Gen. Fil.: 143 (1947).

Aspidium striatum Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 230 (1829).
Aspidium unitum sensu Kuhn, Fil. Afr.: 143 (1868); non Mett.
Nephrodium unitum sensu Chipp, List Herb. Pl. G.C.: 40 (1914); non R. Br.

COLONY. *Western Province*: I. Axim, *Johnson 994* (K); *Johnson* (?) *18/1901* (K). Brawile, near Axim, *Cudjoe 3* (BM; GC). Atuabo, *Fishlock 43* (K). Agona junction—Dixcove road, *Cudjoe 51A* (GC; P; US). IV. Asuansi, *Box 2052* (BM; GC), *2086* (BM; GC). *Eastern Province*: I. Asuokaw, near Adaiso, *Adams 519* (GC). II. Akwapim, *Thonning* (ex Schumach).

ASHANTI. I. Techiman, *Adams & Akpabla 4519* (GC; K). II. Kumasi, *Box 2908* (BM; GC).

A gregarious fern with a wide distribution but rather local, in habitat being mostly confined to well-lit swampy areas in the forest.

THELYPTERIS Schmidel

Thelypteris cruciata (Willd.) Tard. in Notul. Syst. xv: 91 (1954).

Aspidium cruciatum Willd. in L., Sp. Pl., ed. 4, v: 278 (1810).

COLONY. *Eastern Province*: I. Puso Puso ravine, Atewa range, *Scholes 441* (GC); *Adams 322* (BM; GC), *404* (GC; K), *503* (GC), *1188* (GC), *1451* (GC; P).

Rare and local in a steep forested ravine near a permanent stream.

DENNSTAEDTIACEAE

DENNSTAEDTIOIDEAE

MICROLEPIA C. Presl

Microlepia speluncae (L.) Moore, Index Fil.: xciii (1857).

Polypodium speluncae L., Sp. Pl. ii: 1093 (1753).
Davallia speluncae (L.) Bak. in Hook. & Bak., Synops. Fil.: 100 (1867).—Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898).—Chipp, List Herb. Pl. G.C.: 40 (1914).

COLONY. *Western Province*: I. Agona junction—Dixcove road, *Cudjoe 51B* (GC). IV. Asin–Nyankumasi, *Cummins 172* (K). Jakai, near Fanti–Nyankumasi, *Box 2873* (GC; BM). Asuansi, *Box 2874* (BM; GC), *2875* (GC). *Eastern Province*: I. Achiasi, near Oda, *Box 2887* (BM; GC). Tafo, *Darko 162* (GC). Puso Puso ravine, Atewa range, *Adams 407* (GC; K). II. Aburi, *Obeng 19* (GC). Akropong, Akwapim, *Irvine 2613* (GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3392* (GC). Kpeme Hill, near Ahenkro, *Adams 1806* (GC).

ASHANTI. II. Near Bompata, *Vigne 2702* (FHK; GC; K). Lake Bosumtwe, *Box 2902* (BM; GC); *Adams & Akpabla 4540* (GC). Bobiri F.R., *Adams 544* (GC). III. Pra–Anum F.R., *Box 2923* (BM; GC). IV. Near Mampong, *Vigne 4098* (FHK; GC; K).

Near streams in the forest; widespread but never abundant.

DAVALLIOIDEAE

DAVALLIA Sm.

Davallia chaerophylloides (Poir.) Steud., Nom. Bot., Pl. Crypt.: 146 (1824).

Trichomanes chaerophylloides Poir. in Encycl. Méth., Bot. viii: 80 (1808).

COLONY. *Western Province*: IV. Asuansi, *Box 2065* (BM; GC), *2479* (BM). *Eastern Province*: I. Abetifi, *Irvine 316* (GC; K); *Akpabla 199* (GC). Birimsu, *Darko* (GC). Begoro, *Adams 246* (GC), *434* (GC; K; P). Puso Puso ravine, Atewa range, *Adams 332* (GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Scholes 44* (BM; GC).

ASHANTI. II. Kumasi, *Vigne 3049* (FHK; K). Jimira F.R., *Vigne 4236* (FHK; GC; K). Agogo, *Foote 102* (BM; GC). Bobiri F.R., *Adams & Akpabla 4542* (GC). III. Pra–Anum F.R., *Box 2926* (BM; GC). IV. Nsuta, near Mampong, *Vigne 1748* (FHK; K).

Frequent on the high branches of tall trees.

OLEANDROIDEAE

NEPHROLEPIS Schott

Nephrolepis biserrata (Sw.) Schott, Gen. Fil.: sub t. 3 (1834).

Aspidium biserratum Sw. in Schrad., Journ. Bot. 1800, 2: 32 (1801).
Aspidium acutum (Schkuhr) Krypt. Gewächse i: 32, t. 31 (1804).
Aspidium guineense Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 229 (1829).
Nephrolepis acuta (Schkuhr) C. Presl, Tent. Pterid.: 79 (1836).—Oliv. in Burton & Cameron, To the G.C. for Gold ii: 371 (1883).—Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898).
Nephrolepis punctulata var. *hirsuta* Mett. ex Kuhn, Fil. Afr.: 156 (1868).

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K, not seen). Brawile, near Axim, *Cudjoe 1* (GC; K), *2* (GC). II. Tarkwa, *Vigne 4121* (FHK). IV. Nsuta, *Cummins 39/99/182/184* (K). Asuansi, *Box 2032* (BM). *Eastern Province*: I. Assene, *Foote 126* (GC). Potroasi, near Kibi, *Adams 169* (GC). II. Akwapim, *Thonning 1 a & b* (C). Aburi, *Obeng 1* (GC); *Adams 180* (GC), *182* (GC). Achimota (cultivated), *Irvine 2590* (GC). III. Krobo, *Thomas D9* (GC; K).

ASHANTI. II. Bompata, *Vigne 2719* (FHK). Kumasi, *Vigne 4110* (FHK; GC). Agogo, *Foote 34* (GC). IV. Mampong, *Vigne 4099* (FHK; K).

WITHOUT LOCALITY. *Johnson 205* (GC).

Ubiquitous in the forest area and often outside it; the commonest fern. This fern is most frequently found growing among the old leaf bases of oil-palms but may also be terrestrial.

N. punctulata var. *hirsuta* and *Aspidium guineense* are both based on Schumacher's Thonning specimen, which shows the typical hairy juvenile frond.

Nephrolepis undulata (Afz. ex Sw.) J. Sm. in Curt., Bot. Mag. lxxii, Comp.: 35 (bis) (1846).

Aspidium undulatum Afz. ex Sw. in Schrad., Journ. Bot. 1800, 2: 32 (1801).

COLONY. *Western Province*: III. Afao Hills F.R., *Adams 1962* (GC), *2048* (GC). *Eastern Province*: I. Bunsu, *Box 2940* (BM; GC). Begoro, *Adams 435* (BM; GC; K; P). Near Bosuso, *Adams 464* (BM; GC).

SOUTHERN TOGOLAND. I. Togo Plateau F.R., *St. Clair Thompson 1525* (GC; K).

ASHANTI. I. Techiman, *Adams & Akpabla 4481* (BM; GC). IV. Kumawu, *Irvine 2813* (GC). Mampong scarp, *Adams & Akpabla 4532* (BM; GC). Mampong, *Adams 962* (GC).

Occasional as an epiphyte on oil-palms in the hilly and more northerly districts, or on roadside banks and streamsides on light sandy soils. It has been seen on planted oil-palms as far north as Wa in the west and Yendi in the east.

This species is often referred to *N. cordifolia* (L.) C. Presl, which was based on a figure of Petiver's, which is a copy of Plumier's t. 71 in his *Traité des Fougères de l'Amérique* (1705): this plate probably represents *N. occidentalis* Kunze.

SCHIZOLOMA Gaudich.

Schizoloma ensifolium (Sw.) J. Sm. in Hook., Lond. Journ. Bot. iii: 414 (1841).

Lindsaea ensifolia Sw. in Schrad., Journ. Bot. 1800, 2: 77 (1801).

COLONY. *Western Province*: I. West bank of Ancobra R., Axim–Ancobra road, *Morton* (BM; GC).

On rotten tree-stump at edge of mangrove swamp.

OLEANDRA Cav.

Oleandra distenta Kunze in Bot. Zeit. ix: 347 (1851).

COLONY. *Western Province*: IV. Asuansi, *Box 2066* (BM; GC). *Eastern Province*: I. Puso Puso ravine, Atewa range, *Box 3271* (BM; GC); *Adams 502* (GC). Begoro scarp, *Box 3447* (BM). Near Nkawkaw, *Box 3457* (BM; GC). Atewa range, *Box 3502* (BM; GC; K). Omenako, near Kibi, *Box* (GC). Apapam, near Kibi, *Adams 982* (BM; GC). II. Aburi, *Adams 987* (GC; P; US).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3400* (GC); *Scholes 69* (BM; GC).

ASHANTI. II. Kumasi, *Irvine 2810* (GC). Bobiri F.R., *Adams 534* (GC; P). III. Pra–Anum F.R., *Box 2927* (BM; GC).

Occasional as an epiphyte on the high branches of tall trees.

Oleandra ejurana C. D. Adams in Ann. & Mag. Nat. Hist., Ser. 12, vii: 873 (1954).

ASHANTI. IV. Ejura scarp, *Adams GC 4561* (BM; GC); *Morton GC 9763* (BM; GC).

ARTHROPTERIS J. Sm.

Arthropteris monocarpa (Cordem.) C. Chr. in Perrier, Cat. Pl. Madag., Ptérid.: 32 (1931).

Nephrodium monocarpum Cordem., Fl. Réunion: 74 (1895).

COLONY. *Eastern Province*: I. Puso Puso ravine, Atewa range, *Box 3270* (BM; GC); *Adams 323* (GC), *408* (BM; GC; K), *568* (GC; P; US).

Recorded only from this locality, growing on rocks and the trunks of tree-ferns near a permanent stream.

Arthropteris orientalis (J. F. Gmel.) Posth. in Rec. Trav. Bot. Néerl. xxi: 218 (1924).

Polypodium orientale J. F. Gmel. in L., Syst. Nat., ed. 13, ii: 1312 (1791).

Aspidium thonningii Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 229 (1829).—Kuhn, Fil. Afr.: 143 (1868).—Alston in Journ. of Bot. lxxvii: 287 (1939).

COLONY. *Eastern Province*: I. Ntronang, Pra River, *Box 2893* (BM; GC). Near Bosuso, *Box 2944* (BM; GC). Potroasi, near Kibi, *Adams 168* (GC). Begoro, *Adams 245* (BM; GC). II. Akwapim, *Thonning* (C). Aburi, *Johnson 204* (GC); *Adams 989* (GC).

ASHANTI. II. Bompata, *Vigne 2711* (FHK). Agogo, *Foote 103* (BM; GC). Bobiri F.R., *Adams & Akpabla 4547* (GC); *Adams 529* (GC), *536* (GC; P; US). III. Pra–Anum F.R., *Box 2921* (BM). IV. Mampong scarp, *Adams & Akpabla 4534* (GC; K).

A frequent epiphyte on the high branches of trees in the forest; less common on rocks and the trunks of oil-palms.

Arthropteris ramosa (Beauv.) Mett. in Reise Österr. Freg. Novara, Bot. i: 213 (1870).

Aspidium ramosum Beauv., Fl. Oware & Benin ii: 54, t. 91 (1821).

Aspidium sublobatum (Schumach.) in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 235 (1829).

Nephrolepis ramosa (Beauv.) Moore, Index Fil.: 102 (1858).—Kuhn, Fil. Afr.: 156 (1868).—Oliv. in Burton & Cameron, To the G.C. for Gold ii: 371 (1883).—Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898).—Chipp, List Herb. Pl. G.C.: 40 (1914).

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K, not seen). Near Prince's Town, *Cudjoe 96* (GC). IV. Asin–Nyankumasi, *Cummins 93/134* (K). Asuansi, *Box 2033* (BM); *Scholes 163* (GC); *Adams 114* (GC). *Eastern Province*: I. Anyinam, *Obeng 10* (GC; K). Bunsu, *Foote 109* (GC). Puso Puso ravine, Atewa range, *Box 3269* (BM; GC); *Adams 319* (GC). Tafo, *Darko 198* (FHI 12928). Asiakwa, *Adams 192* (GC). Awaham, *Adams 523* (GC; K; P; US). II. Akwapim, *Thonning 308* (C). Aburi, *Johnson 451* (GC; K). Akropong, *Irvine 2612* (GC; K).

ASHANTI. II. Abofaw, *Chipp 536* (FHK; K). Juaso, *Irvine 317* (GC; K). Bompata, *Vigne 2718* (FHK). Konongo, *Darko* (GC). Bobiri F.R., *Adams & Akpabla 4548* (GC); *Adams 547* (GC; P; US).

A frequent scandent epiphyte on the trunks and low branches of trees in the forest. This plant is often identified as *A. obliterata* (R. Br.) J. Sm. The type of *Nephrodium obliteratum* R. Br. is a species of *Nephrolepis*, as stated by Carruthers in Seem., Fl. Vitiens.: 362 (1873).

PTERIDOIDEAE

PTERIDIUM Scop.

Pteridium aquilinum (L.) Kuhn in Decken, Reise Ost-Afr. iii, 3, Bot.: 11 (1879).

Pteris aquilina L., Sp. Pl. ii: 1075 (1753).

Colony. *Western Province*: I. Mielialuma, Basakeh, near Axim, *Cudjoe 65* (GC; P; US). *Eastern Province*: I. Near Begoro, *Adams 462* (BM; GC; K).

Southern Togoland. I. Togo Plateau F.R., *St. Clair Thompson 1513* (GC; K). Amedjofe, *Akpabla 859* (GC); *Box 3434* (BM; GC); *Adams 985* (GC).

Ashanti. II. Near Kumasi, *Box 2903* (BM; GC). IV. Near Mampong, *Box 2930* (BM; GC).

A gregarious fern of secondary formations and roadsides on sandy soil; rather local but more frequent in the hilly districts.

LONCHITIS L.

Lonchitis currori (Hook.) Mett. ex Kuhn in Decken, Reise Ost-Afr. iii, 3, Bot.: 10 (1879).

Pteris currori Hook., Sp. Fil. ii: 232, t. 140 (1858).

Colony. *Western Province*: IV. Near Asuansi, *Box 2051* (BM; GC), *2098* (BM; GC). Foso–Juaso F.R., *Box 2484* (BM; GC). Kakum F.R., near Nfuom, *Box 2851* (BM; GC), *2866* (BM; GC; K). Kakum F.R., near Krua, *Box 2913* (BM; GC). *Eastern Province*: I. Puso Puso ravine, Atewa range, *Adams 337* (BM; GC; P; US).

Southern Togoland. I. Amedjofe, *Irvine 3393* (BM; GC).

Ashanti. II. Near Bompata, *Vigne 2709* (FHK; GC; K). Konongo, *Akpabla 257* (GC; K). Bobiri F.R., *Adams 549* (GC; K; P; US).

Locally common in damp shady places in the forest.

Lonchitis reducta C. Chr. in Fedde, Repert. Sp. Nov. ix: 370 (1911).

Lonchitis pubescens sensu Oliv. in Burton & Cameron, To the G.C. for Gold ii: 371 (1883).—Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898); non Willd.

Colony. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K). Basakeh, near Axim, *Cudjoe 43* (BM; GC). II. Neung F.R., near Tarkwa, *Cudjoe 40* (GC; K). IV. Asin–Nyankumasi, *Cummins 110* (K). Near Asuansi, *Box 2434* (BM; GC). Foso–Juaso F.R., *Scholes 248* (GC; P; US).

Ashanti. II. Bobiri F.R., *Adams 554* (GC).

A gregarious plant of damp low-lying forest; more frequent in the western districts than *L. currori*.

ANISOSORUS Trev. ex Maxon

Anisosorus occidentalis (Bak.) C. Chr., in Perrier, Cat. Pl. Madag., Ptérid.: 54 (1931).

Lonchitis occidentalis Bak. in Hook. & Bak., Synops. Fil.: 128 (1867).

Colony. *Western Province*: II. Near Enchi, *Adams 2184* (GC). III. Near Chirano, *Adams 1982* (GC). *Eastern Province*: I. Puso Puso ravine, Atewa range, *Adams 87*

(BM; GC), *321* (BM; GC), *405* (GC), *413* (GC), *507* (GC; K; P; US). Chapiasi, near Kibi, *Adams 1195* (GC). Kwabeng, *Adams 2689* (GC).

ASHANTI. III. Near Fomena, *Adams 2518* (GC).

Rather rare near permanent streams.

PTERIS L.

Pteris acanthoneura Alston in Mendonça, Contrib. Conhec. Fl. Moçamb. ii: 15, t. 4, 5 (1954).

Pteris spinulifera sensu Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898); non Schumach.
Pteris atrovirens sensu Chipp, List Herb. Pl. G.C.: 40 (1914); non Willd.
Pteris biaurita sensu Irvine, Pl. G.C.: 356 (1930); non L.

COLONY. *Western Province*: IV. Agona–Mankrong, *Vanderpuye 8* (GC). Asuansi, *Adams 112* (GC). *Eastern Province*: I. Assene, *Foote 154* (GC). Kukna, *Bekoe* (GC). Near Suhum, *Adams 152* (GC), *383A* (GC; K). Kukurantumi, *Adams 250* (GC). Begoro, *Adams 433* (GC). II. Akwapim?, *Thonning 305* (C). Afwerase Hills, Aburi, *Obeng 5B* (K). Mampong, *Foote 1* (GC).

ASHANTI. II. Bobiri F.R., *Adams & Akpabla 4545* (GC). III. Brofoyedru, *Cummins 188/1B/83* (K). Amentia, *Irvine 507* (GC; K).

Common by path-sides and in old farms in the forest.

This plant differs from *P. atrovirens* in having Campterioid venation, and in the texture, which is harder, and in being more or less glaucous. In these characters it resembles *P. mildbraedii* which is, however, larger with spinules on the stipe only. *P. mildbraedii* occupies wetter low-lying habitats. The affinity is with the latter species and not with *P. biaurita* as suggested by Bonaparte. *P. acanthoneura* also appears to differ from all other species of *Pteris* in the Gold Coast by having a more or less elongated basal lobe on the acroscopic side of the basal pinna.

There has been inevitable confusion here owing to the apparent similarity of this species and *P. atrovirens* and the fact that Schumacher's Thonning material contains a mixture of both.

Pteris atrovirens Willd. in L., Sp. Pl., ed. 4, v: 385 (1810).

Pteris spinulifera Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 233 (1829).—C. Chr., Index Fil., Suppl. iii: 168 (1934).
Pteris atrovirens var. *spinulifera* (Schumach.) Bonap. in Bull. Mus. Nation. Hist. Nat. Par. xix: 388 (1913).
Pteris atrovirens var. *inermis* Bonap., Not. Ptérid. xiv: 229 (1923).

COLONY. *Western Province*: I. Basakeh, near Axim, *Cudjoe 11* (GC; P). Agona junction–Dixcove road, *Cudjoe 52* (GC). IV. Asuansi, *Box 2034* (BM); *Adams 117* (GC). *Eastern Province*: I. Near Suhum, *Adams 383* (GC; K). Near Begoro, *Adams 431* (GC). Bunsu, *Cudjoe 84* (GC). II. Akwapim, *Thonning* (C). Afwerase Hills, Aburi, *Obeng 24* (GC). Aburi, *Adams 33* (GC), *205* (GC), *1003* (GC). III. Near Odumase, Manya Krobo, *Adams 469* (GC).

SOUTHERN TOGOLAND. I. Kpandu, *Asamany 157* (GC; K). Buem, *Mischlich* (BM).

ASHANTI. II. Jimira F.R., *Vigne 3052* (FHK; GC). Fuller Falls, near Kintampo, *Adams 586* (GC).

Widely distributed and not uncommon on path-sides and in oil-palm groves in the forest.

The original description of *P. atrovirens* makes no mention of spinules, but Baker (in Hook. & Bak., Synops. Fil., ed. 2: 170 (1874)) states, 'rachis of the pinnules beneath sometimes, but not always, furnished with a row of weak prickles'; *P. spinulifera* Schumach. is cited as a synonym. Thonning's specimens in the Copenhagen collection are mixed; some show *Litobrochia* and the others *Campteria* venation. The latter are distinct and are now separated in *P. acanthoneura*. Schumacher did not distinguish venation-type in his description of *P. spinulifera*, but nevertheless all his available material was spinuliferous.

Pteris biaurita L., Sp. Pl. ii: 1076 (1753).

COLONY. *Eastern Province*: III. Boti, near Huhunya, *Adams 280* (BM; GC; K).

ASHANTI. II. Asenanyo F.R., *Adams 1942* (GC; P; US).

WITHOUT LOCALITY. *Johnson 202* (GC).

Rare in forest country.

Pteris burtoni [Oliv. in Burton & Cameron, To the G.C. for Gold ii: 370 (1883), *nom. nud.*] Bak. in Ann. of Bot. v: 218 (1891).

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K). Basakeh, near Axim, *Cudjoe 47* (GC). Bonyere, near Axim, *Cudjoe 58* (GC). II. Neung F.R., near Tarkwa, *Cudjoe 24* (GC; K), *26* (BM; GC). IV. Asuansi, *Box 2050* (BM; GC). Foso–Juaso F.R., *Box 2067* (BM; GC); *Scholes 247* (GC). Bimpong F.R., *Collins* (K). *Eastern Province*: I. Awisa, Akim, *Irvine 2836* (GC). Birim River, Anyinam, *Obeng 5A* (GC). Bunsu, *Scholes 317* (GC). Asiakwa, *Adams 84* (GC), *1184* (GC). Puso Puso ravine, Atewa range, *Adams 92* (GC), *315* (GC; P), *567* (GC), *570* (GC), *571* (GC). Potroasi, near Kibi, *Adams 160* (GC). Near Apapam, near Kibi, *Adams 972* (GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Scholes 64* (BM; GC).

ASHANTI. II. Konongo, *Akpabla 259* (GC; K), *260* (GC; K). Bobiri F.R., *Adams 542* (GC), *551* (GC).

Frequent in the shade on path-sides and by streams in the wet forest area.

This is a polymorphic species within which several forms are recognizable. The forms show degrees of frond dissection ranging from bipinnatifid to tripinnatifid, the simplest form having the sterile frond with the lowest pinnae once-lobed on the basiscopic side, and this lobe, the median pinnae and the terminal pinna simple. The fertile fronds are almost invariably slightly more complex at corresponding stages. A form in which the simple pinnae have long continuous sori may be referable to *P. johnstoni* Bak., but the type of this species at Kew is inadequate for reliable comparison.

Intermediate forms have the pinnae very irregularly lobed, there being a marked variation in the length of adjacent lobes and occasional absence of lobes over sections of the pinna margin, especially on the acroscopic side.

The most highly developed fronds are to be found on larger, and presumably older, plants where they resemble those of *P. atrovirens*. In such specimens the dissection is regular and tripinnatifid at the base.

Throughout this group of forms there is also considerable variation in the presence or absence of costal spinules, the prominence of veinlets, and the size of areolae. Further study is required.

P. burtoni is distinguished from other Gold Coast species of *Pteris*, except *P. similis*, by the invariable presence of one or more proliferating buds in the upper pinna axils. *P. similis* differs in its larger size, lighter green colour, stramineous stipe and rhachis with coarse spines, wider and more rounded sinuses, more copious roots, and in its occupation of a swampy well-lit habitat.

Pteris mildbraedii Hieron. in Engl., Bot. Jahrb. liii: 415 (1915).

Pteris biaurita sensu Oliv. in Burton & Cameron, To the G.C. for Gold ii: 370 (1883); non L.

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K). Mielialuma, Basakeh, near Axim, *Cudjoe 59* (BM; GC; P; US). IV. Foso–Juaso F.R., *Scholes 254* (GC).

'From muddy stream-bank in virgin forest' (Cudjoe).

See also note under *P. acanthoneura*.

Pteris quadriaurita Retz., Obs. Bot. vi: 38 (1791).—Cummins in Bull. Misc. Inf. Kew, 1898: 81 (1898).

COLONY. *Western Province*: IV. Asuansi, *Box 2056* (BM; GC). *Eastern Province*: I. Assene, *Foote 142* (GC). Near Begoro, *Box 2947* (BM; GC). Potroasi, near Kibi, *Adams 159* (GC), *163* (GC). Puso Puso ravine, Atewa range, *Adams 329* (GC), *416* (GC). Bunsu, *Cudjoe 78* (GC; P). II. Afwerase Hills, Aburi, *Obeng 22* (GC; K). Akropong, *Irvine 2614* (GC; K); *Adams 1002* (GC). Aburi, *Box 2879* (BM; GC). Near Mamfe, *Adams 299* (GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Scholes 66* (BM; GC). Kpandu, *Adams 1796* (GC).

ASHANTI. I. Fuller Falls, near Kintampo, *Adams 587* (GC). II. Merishe, near Adiembra, *Kitson 1226* (K). Bompata, *Vigne 2710* (FHK). Konongo, *Akpabla 255* (GC; K). Agogo, *Foote 41* (GC). Lake Bosumtwe, *Adams 95* (GC). III. Mansi Hills, *Cummins 7B* (K). Near Bekwai, *Box 2895* (GC). IV. Mampong, *Vigne 4101* (FHK; K).

Frequent by paths and roads in the forest, especially in the hilly districts. Apparently less common in the west.

This aggregate, as here construed, may consist of several separable species. *P. togoensis* Hieron. has been recorded near Ho, Southern Togoland I (*Schröder 186*), and may be different. Further study of this group is required.

Pteris similis Kuhn in Decken, Reise Ost-Afr. iii, 3, Bot.: 21 (1879).

COLONY. *Eastern Province*: II. Aburi, *Johnson 203* (GC; K).

SOUTHERN TOGOLAND. I. Amedjofe, *Scholes 65* (BM).

ASHANTI. I. Fuller Falls, near Kintampo, *Adams 581* (GC). II. Bobiri F.R., *Adams 555* (GC; K). III. Pra–Anum F.R., *Box 2925* (BM; GC).

Uncommon. Near streams and in well-illuminated swampy parts of the forest. See also note under *P. burtoni*.

Pteris tripartita Sw. in Schrad., Journ. Bot. 1800, 2: 67 (1801).

Pteris marginata Bory, Voy. Afr. i: 402 (1804).—Chipp, List Herb. Pl. G.C.: 40 (1914).

COLONY. *Western Province*: III. Near Bibiani, *Adams 2085* (GC; P; US). *Eastern Province*: I. Kukurantumi, *Johnson 860* (GC; K). Near Kibi, *Box 3507* (BM; GC).

ASHANTI. II. Ahwireso, *Akpabla 287* (GC; K). South Fomangsu F.R., *Box 3459* (BM). Bobiri F.R., *Adams 552* (GC; K).

A rare plant of clearings in the forest.

All plants recorded from the country show *Litobrochia* venation.

Pteris vittata L., Sp. Pl. ii: 1074 (1753).

COLONY. *Western Province*: III. Bibiani, *Adams 1927* (GC), *1945* (GC).

ASHANTI. III. Obuasi, *Adams 2495* (BM; GC; K; P; US).

ACROSTICHUM L.

Acrostichum aureum L., Sp. Pl. ii: 1069 (1753).—Chipp, List Herb. Pl. G.C.: 39 (1914). A. Chev., Explor. Bot. Afr. Occ. Franç.: 774 (1920).—Irvine, Pl. G.C.: 7 (1930).

COLONY. *Western Province*: I. Pra River, *Johnson 996* (GC; K). Sekondi, *Chipp 216* (FHK; K). Axim, *Chevalier* (P); *Irvine 2131* (GC; K); *Cudjoe 49* (GC; K), *75* (GC; P; US). Bonyere, near Axim, *Cudjoe 57* (GC). Eikwe, *Cudjoe 64* (GC). Ancobra River, *Foote 123* (GC). Nhwini River, near Takoradi, *Box 2076* (BM; GC). IV. Agona-Mankrong, *Vanderpuye 4* (GC).

Locally abundant as a conspicuous member of the mangrove associations in the estuaries of the larger rivers and lagoons of the west. The record of this plant from Angona-Mankrong is worthy of special note as this is inland at least 40 km. from the nearest point on the coast. The species is also known from a fresh-water swamp a few km. south of Nsaba in the same area, and a similar locality between Adaiso and Nsawam.

ASPLENIOIDEAE

ASPLENIUM L.

Asplenium africanum Desv. in Mag. Ges. Naturforsch. Freunde Berl. v: 322 (1811).

Asplenium sinuatum Beauv., Fl. Oware & Benin ii: 33, t. 79 fig. 1 (1816); non *A. sinuatum* Salisb. (1796).—Kuhn, Fil. Afr.: 116 (1868).—Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898).

Asplenium guineense Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 232 (1829).

COLONY. *Western Province*: I. Mielialuma, Basakeh, near Axim, *Cudjoe 63* (GC; P; US), *68* (GC), *72* (GC). II. Simpa, *Vigne 2914* (FHK; K). IV. Asin–Nyankumasi, *Cummins 61* (K). Asuansi, *Box 2072* (BM; GC), *2882* (BM; GC). *Eastern Province*: II. Akwapim, *Thonning* (C). Aburi, *Adams 990* (GC).

A rather uncommon epiphyte on forest trees and oil-palms; more prevalent in the western areas. This species is easily confused with *A. currori* and may be more common than the number of recorded specimens would suggest.

Asplenium akimense C. D. Adams in Ann. & Mag. Nat. Hist., Ser. 12, vii: 873 (1954).

COLONY. *Eastern Province*: I. Puso ravine, Atewa range, *Cudjoe GC 3829* (BM; GC).

Asplenium barteri Hook., Sec. Cent. Ferns: t. 75 (1861).

Asplenium macrophlebium sensu Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898).—Chipp, List Herb. Pl. G.C.: 39 (1914); non Bak.

COLONY. *Western Province*: II. Simpa, *Vigne 2913* (FHK; K). *Eastern Province*: I. Begoro, *Johnson 721* (GC; K); *Box 3449* (BM). Akrum River, near Begoro, *Box 2950 pro parte* (BM; GC); *Adams 425* (BM; GC; P), *455* (GC). Near Bosuso, *Box 2943 pro parte* (BM). Atewa range F.R., *Box 3504* (BM; GC). Puso Puso ravine, Atewa range, *Scholes 443* (GC); *Adams 85* (GC), *334* (GC), *410* (GC), *508* (BM; GC). II. Aburi, *Johnson 451A* (GC).

ASHANTI. III. Brofoyedru, Mansi Hills, *Cummins 3B* (K).

A low-level epiphyte on the trunks of large trees, the branches of small trees, and sometimes on rocks. Locally plentiful near streams in hilly parts of the wet forest. This is a variable fern showing a great range in the size and shape of the pinnae.

Asplenium buettneri Hieron. apud Mildbr. in Wiss. Ergebn. Deutsch. Z.-Afr.-Exped. ii: 23 (1910).

Asplenium furcatum sensu Chipp, List Herb. Pl. G.C.: 39 (1914); non Thunb.

COLONY. *Eastern Province*: I. Abetifi, *Scholes 107* (BM; GC). II. Road to Dodowah, Akwapim, *Johnson 590* (GC; K). Konkonura Falls, Aburi, *Johnson 993* (GC; K). Aburi, *Irvine 62* (GC; K). Mampong, Akwapim, *Box 2092* (BM; GC); *Foote 5* (GC); *Todd* (GC). III. Volta River F.R., *Adams 365* (BM; GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3380* (GC).

ASHANTI. II. Lake Bosumtwe, *Box 2899* (BM; GC); *Adams & Akpabla 4538* (GC; K; P; US).

A local terrestrial fern of steep rocky slopes in the forest, especially in gullies in the upland regions.

Asplenium cuneatum Lam. in Encycl. Méth., Bot. ii: 309 (1786).

COLONY. *Eastern Province*: I. Puso Puso ravine, Atewa range, *Adams 330* (BM; GC). Akrum River, near Begoro, *Adams 426* (GC; P; US), *453* (GC), *457* (BM; GC; K).

Epiphytic on the trunks of trees or tree-ferns near permanent streams in virgin forest. Rare.

Asplenium currori Hook., Sp. Fil. iii: 82 (1860).

COLONY. *Western Province*: IV. Foso–Juaso F.R., *Box 2070* (BM; GC). Asuansi, *Scholes 173* (GC). *Eastern Province*: I. Assene, *Foote 131* (GC). Potroasi, near Kibi, *Adams 171* (GC). Akrum River, near Begoro, *Adams 456* (GC). Apapam, near Kibi, *Adams 977* (GC; P; US). II. Near Aburi, *Johnson 206*? (K). Aburi, *Obeng 3A* (GC; K); *Akpabla 626* (GC); *Adams 179A* (GC), *210* (GC). III. Volta River F.R., *Adams 372* (GC).

ASHANTI. II. Bobiri F.R., *Adams 548* (GC). IV. Near Jamasi, *Adams & Akpabla 4529* (BM; GC; K).

A common epiphyte on the trunks and low branches of trees in the forest and sometimes on rocks.

This species is similar to *A. africanum* but differs in the stipe which is much shorter and almost obsolete, in the scales of the rhizome which have larger thin-walled cells, and in the habit of the frond, which is more elongated and less rigid, so that in life it normally hangs down, whereas that of *A. africanum* stands erect.

Asplenium diplazisorum Hieron. in Engl., Bot. Jahrb. xlvi: 351 (1911).

COLONY. *Eastern Province*. I. Bosuso, *Box 2943 pro parte* (BM; GC). Akrum River, near Begoro, *Box 2950 pro parte* (BM). Puso Puso ravine, Atewa range, *Box 3260* (BM; GC). Bunsu, *Thompson* (BM).

'On boulders in a forest ravine. Alt. 1200'' (Box). Very rare.

Asplenium dregeanum Kunze in Linnaea x: 517 (1836).

Asplenium brachyopterum Kunze [op. cit. xxiii: 232 (1850) (*brachypteron*), *nom. nud.*] Houlston & Moore in Gard. Mag. Bot. 1851: 260 (1851).—Chipp, List Herb. Pl. G.C.: 39 (1914).

COLONY. *Eastern Province*: I. Mpraeso Hills, *Johnson 671* (GC; K).

SOUTHERN TOGOLAND. I. Amedjofe, *Scholes 62* (BM); *Box 3433* (BM; GC; K).

ASHANTI. I. Adamsu, *Vigne 3517* (FHK; GC).

An epiphyte on trees and rocks at altitudes approaching and over 600 m.

Asplenium emarginatum Beauv., Fl. Oware & Benin ii: 6, t. 61 (1808).

COLONY. *Eastern Province*: II. Aburi Hills, *Johnson 207* (GC). Mampong, Akwapim, *Box 2089* (BM; GC), *3275* (BM; GC); *Foote 2–4* (GC); *Darko* (GC). Nsawam–Aburi road, Akwapim, *Box 2878* (BM; GC). III. Peji Hill, Anum, *Adams 141* (GC; K). Volta River F.R., *Adams 373* (BM; GC), *517* (GC). Near Anyaboni, Dawa, *Adams 1000* (GC).

ASHANTI. III. Pra–Anum F.R., *Box 2928* (BM; GC).

Locally common among rocks in leafy soil on slopes in the forest or in dry woods in the zone transitional to savannah.

This species is a conspicuous member of an association of small terrestrial ferns found in such places, including *Pellaea doniana, Doryopteris concolor, Asplenium buettneri, Asplenium currori* (on rocks) and *Adiantum* spp.

Asplenium formosum Willd. in L., Sp. Pl., ed. 4, v: 329 (1810).

COLONY. *Eastern Province*: I. Abetifi, *Scholes 106* (BM; GC).

SOUTHERN TOGOLAND. I. Togo Plateau F.R., *St. Clair Thompson 1635* (GC). Amedjofe, *Irvine 3343* (GC; K). Kpeme Hill, near Ahenkro, *Adams 1811* (GC).

ASHANTI. I. Fuller Falls, near Kintampo, *Adams 585* (GC; P; US). II. Agogo, *Foote 33* (BM).

Local on mossy rocks and the trunks of trees at higher elevations in the forest to savannah transitional zone and the more northerly parts of the forest.

Asplenium geppii Carruth. in Cat. Afr. Pl. Welw. ii: 269 (1901).

COLONY. *Eastern Province*: I. Akrum River, near Begoro, *Adams 428* (GC), *452* (BM; GC; K). Near Apapam, near Kibi, *Adams 978* (GC; US).

Rare and local. Epiphytic on tree-trunks in humid sheltered places above 300 m.

Asplenium hemitomum Hieron. in Engl., Bot. Jahrb. xlvi: 365 (1911).

COLONY. *Western Province*: IV. Kakum F.R., *Box 2863* (BM; GC). *Eastern Province*: I. Begoro, *Irvine 1351* (K); *Adams 242* (BM; GC; K), *448* (GC), *458* (GC). Akrum River, near Begoro, *Box 2946* (BM); *Adams 429* (GC). II. Aburi, *Box 2087* (BM; GC); *Adams 177* (GC).

ASHANTI. I. Fuller Falls, near Kintampo, *Adams 582* (GC). II. Kwabia, *Vigne 4018* (FHK; K). Ofinso, *Cox 1* (K). III. Pra–Anum F.R., *Box 2922* (BM; GC).

An epiphyte on the trunks and low branches of trees and sometimes on rocks in damp places in the forest. Widely distributed but nowhere common.

Asplenium megalura Hieron. apud Mildbr. in Wiss. Ergebn. Deutsch. Z.-Afr.-Exped. ii: 17 (1910).

COLONY. *Eastern Province*: I. Apapam, near Kibi, *Adams 969* (BM; GC; P), *981* (GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3395* (GC).

A rare epiphyte in wet hilly districts.

Asplenium paucijugum Ballard in Hook., Ic. Pl. xxxiii: t. 3287 (1935).

COLONY. *Western Province*: II. Neung F.R., near Tarkwa, *Cudjoe 22* (BM; GC; K). IV. Asuansi, *Box 2036* (BM; GC), *2095* (BM; GC). *Eastern Province.* I. Puso Puso ravine, Atewa range, *Box 3261* (BM).

ASHANTI. II. Near Bompata, *Vigne 2712* (FHK; K). Bobiri F.R., *Adams 546* (GC; P; US).

WITHOUT LOCALITY. *Scholes 343* (BM; GC).

Terrestrial or epiphytic on the roots of shrubs and trees in damp shady places in the forest. Rather local.

This fern is indistinguishable from *A. variabile* in the juvenile simple-fronded state, except that the uncurling frond has more paleae which are early caducous, and the base of the lamina is more truncate and less decurrent on the stipe. *A. variabile* never has pinnate fronds whereas the mature fruiting fronds of *A. paucijugum* are nearly always pinnate.

Asplenium suppositum Hieron. in Engl., Bot. Jahrb. xlvi: 353 (1911).

COLONY. *Eastern Province*: I. Near Begoro, *Box 3448* (BM; GC; K). III. Near Otrokpe, *Adams 563* (GC; P; US).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3347* (GC).

ASHANTI. II. Agogo, *Adams 2709* (GC).

A rare species usually epiphytic but sometimes on rocks in the forest.

Asplenium unilaterale Lam. in Encycl. Méth., Bot. ii: 305 (1786).

COLONY. *Western Province*: II. Boin River F.R., *Adams 2143* (GC). Near Enchi, *Adams 2159* (GC). III. Near Chirano, *Adams 1981* (GC). *Eastern Province*: I. Kibi, *Johnson 260* (GC; K). Ntronang, Pra River, *Box 2894* (BM; GC). Puso Puso ravine, Atewa range, *Box 3268* (BM; GC), *3463* (BM; GC); *Adams 88* (GC), *326* (GC; K; P; US). Near Asiakwa, *Adams 193* (GC).

ASHANTI. II. South Fomangsu F.R., *Box 3460* (BM; GC). III. Near Fomena, *Adams 2514* (GC; US).

Terrestrial, creeping on banks, or on rocks in very damp shady places. Locally abundant.

Asplenium variabile Hook., Sp. Fil. iii: 93, t. 185 (1860).

Asplenium efulense Bak. in Bull. Misc. Inf. Kew 1901: 137 (1901).—Irvine, Pl. G.C.: 43 (1930).

COLONY. *Western Province*: I. Mielialuma, Basakeh, near Axim, *Cudjoe 69* (BM; GC), *70* (GC), *71* (GC). IV. Kakum River, Asuansi, *Box 2084* (BM; GC), *2085* (BM; GC). Near Asuansi, *Box 2433* (BM; GC). *Eastern Province*: I. Near Bosuso, *Box 2942* (BM; GC). Bunsu, *Box 3468* (GC); Puso Puso ravine, Atewa range, *Adams 327* (GC), *333* (BM; GC; P; US), *411* (BM; GC; K), *498* (GC). Near Begoro, *Adams 451* (GC).

ASHANTI. II. Asenanyo F.R., *Adams 1933* (GC). III. Amentia, *Irvine 461* (K).

Epiphytic on the roots of trees or on rocks near streams in the forest. Local but occasionally abundant.

LOMARIOPSIDOIDEAE

BOLBITIS Schott

Bolbitis acrostichoides (Afz. ex Sw.) Ching in C. Chr., Ind. ex Fil., Suppl. iii: 47 (1934).

Hemionitis acrostichoides Afz. ex Sw. in Schrad., Journ. Bot. 1800, 2: 17 (1801).

COLONY. *Western Province*: IV. Kakum F.R., near Nfuom, *Box 2853* (BM; GC), *2859* (BM; GC), *2864* (BM; GC), *2867* (BM; GC). *Eastern Province*: I. Begoro, *Irvine 1179* (GC); *Adams 427* (GC; K; P). Puso Puso ravine, Atewa range, *Adams 76* (GC), *93* (GC), *1189* (GC).

SOUTHERN TOGOLAND. I. Kpeme Hill, near Ahenkro, *Adams 1805* (GC). Waribo mountain, north of Wurupong, *Adams 1846* (GC).

ASHANTI. II. Agogo, *Foote 104* (GC). IV. Mampong, *Vigne 4104* (FHK; K); *Box 2906* (BM; GC).

WITHOUT LOCALITY. *Darko 6–8* (GC).

Not uncommon among rocks and stones near streams in the forest.

Bolbitis auriculata (Lam.) Alston in Journ. of Bot. lxxii, Suppl. 2: 3 (1934).

Acrostichum auriculatum Lam. in Encycl. Méth., Bot. i: 36 (1783).
Acrostichum punctulatum Sw. in Schrad., Journ. Bot. 1800, 2: 12 (1801).—Cummins in Bull. Misc. Inf. Kew 1898: 82 (1898).

COLONY. *Western Province*: I. Basakeh, near Axim, *Cudjoe 19* (GC; K; P; US). Near Prince's Town, *Cudjoe 92* (GC). IV. Asin–Nyankumasi, *Cummins 70/231* (K). Near Asuansi, *Box 2431* (BM; GC), *2857* (BM). Kakum River, Asuansi, *Box 2478* (BM; GC); *Scholes 176* (GC). Foso–Juaso F.R., *Scholes 257* (BM). *Eastern Province*: I. Bunsu, *Foote 114* (GC); *Scholes 323* (GC); *Cudjoe 82* (GC). Achiasi, near Oda, *Box 2889* (BM). Puso Puso ravine, Atewa range, *Adams 86* (GC), *320* (GC). Potroasi, near Kibi, *Adams 156* (GC). Near Asiakwa, *Adams 1182* (GC). II. Aburi and Obosumasi, *Johnson 210* (GC). Akropong, *Irvine 2615* (GC; K).

SOUTHERN TOGOLAND. I. Amedjofe, *Scholes 67* (BM; GC).

ASHANTI. II. Bompata, *Vigne 2713* (FHK; K). Bobiri F.R., *Adams & Akpabla 4544* (GC), *4546* (GC); *Adams 533* (GC). III. Bekwai–Manso Nkwanta road, *Box 2910* (BM).

Common in the wetter parts of the forest in deep leafy soil in shade.

Bolbitis fluviatilis (Hook.) Ching in C. Chr., Index Fil., Suppl. iii: 48 (1934).—Alston in Journ. of Bot. lxxvii: 284 (1939).

Acrostichum fluviatile Hook., Sp. Fil. v: 274 (1864).—Oliv. in Burton & Cameron, To the G.C. for Gold ii: 371 (1883).

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K). *Eastern Province*: I. Puso Puso ravine, Atewa range, *Adams 331* (BM; GC), *415* (BM; GC; K; P; US), *1190* (GC).

Rare on rocks in permanent streams in the forest.

Bolbitis gemmifera (Hieron.) C. Chr., Index Fil., Suppl. iii: 48 (1934).

Leptochilus gemmifer Hieron. in Engl., Bot. Jahrb. xlvi: 345 (1911).

COLONY. *Western Province*: I. Basakeh, near Axim, *Cudjoe 45* (GC; K; P; US). IV. Foso–Juaso F.R., *Box 2068* (BM; GC); *Scholes 257A* (GC). Asuansi, *Box 2883* (BM; GC); *Scholes 151* (GC). *Eastern Province*: I. Puso Puso ravine, Atewa range, *Adams 316* (GC). Apapam, near Kibi, *Adams 979* (GC). II. Mampong, *Foote 2* (BM).

SOUTHERN TOGOLAND. I. Waribo mountain, north of Wurupong, *Adams 1820* (GC).

ASHANTI. II. Agogo, *Foote 107* (BM). Bobiri F.R., *Adams 553* (GC).

Occasional by paths in the forest.

Bolbitis heudelotii (Bory ex Fée) Alston in Journ. of Bot. lxxii, Suppl. 2: 3 (1934); op. cit. lxxvii: 285 (1939).

Gymnopteris heudelotii Bory ex Fée, Acrost: 84, t. 45 (1845).

COLONY. *Western Province*: I. Basakeh, near Axim, *Cudjoe 13* (GC; K; P; US). IV. Kakum River, Asuansi, *Box 2082* (BM; GC), *2083* (BM; GC); *Scholes 183* (GC). *Eastern Province*: I. Atewa range, *Vigne 4333* (FHK). Achiasi, near Oda, *Box 2892* (BM; GC). Sapong River, Awaham, *Adams 518* (GC; K; P; US).

SOUTHERN TOGOLAND. I. Buem, *Mischlich* (BM).

ASHANTI. I. Near Kintampo, *Dalziel 73* (K). Fuller Falls, near Kintampo, *Adams 577* (GC).

Widely distributed but confined to rocks in streams in well-lit places.

Bolbitis salicina (Hook.) Ching in C. Chr., Index Fil., Suppl. iii: 50 (1934).

COLONY. *Western Province*: III. Near Chirano, *Adams 1978* (BM; GC; K; P; US).

LOMARIOPSIS Fée

Lomariopsis guineensis (Underw.) Alston in Journ. of Bot. lxxii, Suppl. 2:5 (1934).

Acrostichum sorbifolium sensu Oliv. in Burton & Cameron, To the G.C. for Gold ii: 371 (1883); non L.—Cummins in Bull. Misc. Inf. Kew 1898: 82 (1898).
Stenochlaena guineensis Underw. in Bull. Torr. Bot. Club xxxiii: 46, fig. 3 (1906).

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K). Near Axim, *Irvine 2241* (GC; K). Abra, near Axim, *Box 2871* (BM; GC); Mielialuma, Basakeh, near Axim, *Cudjoe 61* (GC; P; US). IV. Asin–Nyankumasi, *Cummins 221* (K). Asuansi, *Box 2035* (BM; GC); *Scholes 149* (GC), *155* (GC), *156* (GC), *182* (GC), *215* (GC), *276* (BM). Foso, *Box 2880* (BM; GC). Kakum F.R., near Krua, *Box 2916* (BM; GC). Foso–Juaso F.R., *Scholes 250* (GC). Kakum F.R., near Nfuom, *Box 2937* (GC; K). *Eastern Province*: I. Kibi, *Johnson 243* (K). Anyinam, *Obeng 14* (GC). Bunsu, *Irvine 3017* (GC); *Foote 116* (GC.) Nkwanta, near Oda, *Box 2891* (BM). Near Asiakwa, *Adams 1183* (GC).

SOUTHERN TOGOLAND. I. Kabo River F.R., *St. Clair Thompson 1695* (GC).

ASHANTI. II. Near Bompata, *Vigne 2714* (FHK; GC). Bobiri F.R., *Adams 527* (GC), *535* (GC), *550* (GC). III. Near Bekwai, *Box 2896* (BM; GC). Bekwai–Manso Nkwanta road, *Box 2909* (BM; GC).

WITHOUT LOCALITY. *Fishlock* (K).

Common in low-lying parts of the wet forest climbing on the stems of shrubs and young trees.

Lomariopsis palustris (Hook.) Mett. ex Kuhn, Fil. Afr.: 53 (1868).

Acrostichum palustre Hook., Sp. Fil. v: 214 (1864).

COLONY. *Western Province*: II. Neung F.R., near Tarkwa, *Cudjoe 25* (GC). IV. Kakum River, Asuansi, *Box 2482* (BM; GC), *2884* (BM). Asuansi, *Scholes 162* (GC), *181* (GC); *Adams 113* (GC). *Eastern Province*: I. Near Asiakwa, *Adams 194* (BM; GC). Puso Puso ravine, Atewa range, *Adams 328* (GC), *499* (GC; K).

ASHANTI. II. Asenanyo F.R., *Adams 1932* (GC).

Rather rare on rocks near permanent streams and occasionally on the stems of shrubs or trees in very wet places in the forest.

Unless fertile fronds are present this species is almost indistinguishable from juvenile plants, or basal branches from old plants, of *L. guineensis*.

Lomariopsis rossii Holtt. in Bull. Misc. Inf. Kew, 1939: 625 (1939).

COLONY. *Western Province*: I. Mielialuma, Basakeh, near Axim, *Cudjoe 59B* (GC), *62* (GC), *67* (GC; P; US). IV. Asuansi?, *Scholes 216* (GC). Foso–Juaso F.R., *Scholes*

249 (GC). Kakum F.R., near Nfuom, *Box 2938* (BM; GC), *2938A* (BM; GC). *Eastern Province*: I. Puso Puso ravine, Atewa range, *Adams 74* (BM; GC), *1191* (GC).

Occupying similar habitats to *L. guineensis* but much less common.

L. rossii is readily distinguished from the other species by the winged rhachis and pinnate juvenile fronds. This fern is very rare in fruit and has been collected only once in this condition in the Gold Coast. The fruiting frond is like that of *L. guineensis*, the wing of the rhachis being very narrow.

TECTARIOIDEAE

CTENITIS C. Chr.

Ctenitis cirrhosa (Schumach.) Copel., Gen. Fil.: 124 (1947).

> *Aspidium cirrhosum* Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 231 (1829).—Kuhn, Fil. Afr.: 127. (1868).

COLONY. *Western Province*: IV. Asuansi, *Box 2876* (BM; GC). Kakum F.R., near Krua, *Box 2917* (BM; GC). *Eastern Province*: I. Bunsu, *Scholes 326* (BM); *Cudjoe 81* (GC; US). Puso Puso ravine, Atewa range, *Adams 494* (GC; K; P). II. Akwapim, *Thonning* (ex Schumach.).

ASHANTI. II. Bobiri F.R., *Adams 532* (GC; P).

An uncommon terrestrial fern in the undergrowth of wet forest.

Ctenitis currori (Mett.) Tard. in Notul. Syst. xiv: 342 (1952).

> *Aspidium currori* Mett. in Kuhn, Fil. Afr.: 130 (1868).

Var. **currori.**

COLONY. *Western Province*: III. Near Chirano, *Adams 1986* (GC). *Eastern Province*: I. Kibi, *Johnson 247* (G.C.); *Adams 1186* (G.C.). Near Bosuso, *Box 2945* (BM; GC). Puso Puso ravine, Atewa range, *Box 3264* (BM; GC); *Adams 80* (BM; GC), *313* (BM; GC; K), *335* (BM; GC). Between Abempe and Adawsoasi, *Todd* (GC). Near Potroasi, near Kibi, *Adams 166* (BM; GC), *392* (GC). Near Begoro, *Adams 461* (GC).

ASHANTI. II. South Fomangsu F.R., *Adams 2653* (GC).

Remarkably local in occurrence but occasionally abundant in undergrowth and along paths in the forest of the Atewa range and neighbouring hills.

Var. **tomentella** (C. Chr.), Adams & Alston, comb. nov.

> *Dryopteris tomentella* C. Chr., Index Fil.: 298 (1905).

COLONY. *Eastern Province*: I. Atewa range, *Box 3505A* (BM; GC). Puso Puso ravine, Atewa range, *Adams 509* (GC).

'On steep bank by path in forested ravine. Alt. 425 m.' (Adams). Rare.

Ctenitis jenseniae (C. Chr.) Tard. in Notul. Syst. xiv: 342 (1952).

> *Dryopteris jenseniae* C. Chr. in Dansk Bot. Ark. ix, 3: 63 (1937).

COLONY. *Western Province*: I. Near Basakeh, near Axim, *Cudjoe 42* (GC). Brawile, near Axim, *Cudjoe 38* (GC). Axim–Agona junction road, *Cudjoe 55A* (GC). II. Neung F.R., near Tarkwa, *Cudjoe 21* (GC), *41* (GC). Mpesem F.R. near Prestea, *Cudjoe 29* (GC; K; P; US). IV. Foso–Juaso F.R., *Box 2069* (BM; GC), *2485* (BM; GC); *Scholes 253* (GC), *255* (GC). Near Asuansi, *Box 2097* (BM), *2435* (GC). Kakum F.R., near Nfuom, *Box 2868 pro parte* (BM). *Eastern Province*: I. Near Asiakwa, *Adams 196* (GC), *200* (GC). Puso Puso ravine, Atewa range, *Adams 572* (GC).

ASHANTI. II. Near Bompata, *Vigne 2707* (FHK; K).

Locally common in damp low-lying places in the forest.

Ctenitis lanigera (Mett.) Tard. in Notul. Syst. xiv: 343 (1952).

Aspidium lanigerum Mett. in Kuhn, Fil. Afr.: 135 (1868).

COLONY. *Eastern Province*: I. Puso Puso ravine, Atewa range, *Box 3267* (BM; GC); *Adams 81* (BM; GC). Near Potroasi, near Kibi, *Adams 154* (BM; GC), *155* (GC).

SOUTHERN TOGOLAND. I. Buem, *Mischlich* (BM). Amedjofe, *Irvine 3394* (GC).

ASHANTI. III. Near Fomena, *Adams 2499* (GC).

Rather rare on clay banks and by path sides in the forest.

Ctenitis protensa (Afz. ex Sw.) Copel., Gen. Fil.: 124 (1947).

Aspidium protensum Afz. ex Sw. in Schrad., Journ. Bot. 1800, 2: 36 (1801).—Kuhn, Fil. Afr.: 139 (1868).

Aspidium subquinquefidum Beauv., Fl. Oware & Benin i: 34, t. 19 (1805).

Polypodium pubescens Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 227 (1829).

Nephrodium subquinquefidum (Beauv.) Hook., Sp. Fil. iv: 130 (1862).—Oliv. in Burton & Cameron, To the G.C. for Gold ii: 371 (1883).—Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898).—Chipp, List Herb. Pl. G.C.: 40 (1914).

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K). Benyimade, near Axim, *Cudjoe 9* (GC; K; P; US). Axim–Agona junction road, *Cudjoe 55B* (GC). IV. Asuansi, *Box 2040* (BM; GC); *Scholes 230* (GC). *Eastern Province*: I. Assene, *Foote 117* (GC). Bunsu, *Foote 113* (GC). Puso Puso ravine, Atewa range, *Adams 314* (BM; GC), *417* (GC). Near Potroasi, near Kibi, *Adams 391* (GC). Near Apapam, near Kibi, *Adams 974* (GC). II. Akwapim, *Thonning 301* (C). Mampong, Akwapim, *Foote 8* (GC). Near Aburi, *Obeng 23* (K); *Adams 178* (BM; GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3396* (GC).

ASHANTI. II. Konongo, *Akpabla 256* (GC; K). Agogo, *Foote 105* (GC).

A fairly common terrestrial fern in the forest.

Ctenitis securidiformis (Hook.) Copel., Gen. Fil.: 125 (1947).

Nephrodium subquinquefidum var. *securidiforme* Hook., Sp. Fil. iv: 130 (1862).

Aspidium securidiforme (Hook.) Mett. in Kuhn, Fil. Afr.: 141 (1868).

COLONY. *Western Province*: IV. Kakum F.R., near Nfuom, *Box 2860* (BM; GC), *2868 pro parte* (BM; GC). *Eastern Province*: I. Begoro Hills, *Johnson 722* (GC; K). Near Bosuso, *Box 2941* (BM; GC). Puso Puso ravine, Atewa range, *Scholes 442* (BM; GC). Atewa range, *Box 3505* (BM; GC). Near Asiakwa, *Adams 186* (GC), *189* (GC).

Uncommon. Near permanent streams and in damp shady places in the forest.

Ctenitis variabilis (Hook.) Tard. in Notul. Syst. xiv: 343 (1952).

Nephrodium variabile Hook., Sp. Fil. iv: 140 (1862).—Oliv. in Burton & Cameron, To the G.C. for Gold ii: 371 (1883).—Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898).

Var. **variabilis.**

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K). Near Axim, *Irvine 2306* (GC; K). Basakeh, near Axim, *Cudjoe 12* (GC). Near Prince's Town, *Cudjoe 93* (GC). II. Mpesem F.R., near Prestea, *Cudjoe 31* (GC). Neung F.R., near Tarkwa, *Cudjoe 32* (GC). IV. Brofoyedru, Mansi Hills, *Cummins 4B* (K). Kakum F.R., near Nfuom, *Box 2852* (BM; GC), *2869* (BM; GC). Asuansi, *Box 2049* (BM; GC); *Scholes 216A* (GC). Foso–Juaso F.R., *Box 2486* (BM; GC). *Eastern Province*: I. Nkwanta, near Oda, *Box 2890* (BM; GC). Near Asiakwa, *Adams 185* (GC), *1181* (GC). Bunsu, *Adams 1765* (GC).

ASHANTI. II. Near Bompata, *Vigne 2704* (FHK; K). South Fomangsu F.R., *Adams 2539* (GC), *2649* (GC).

Common in damp low-lying places in the forest.

Var. **speciosa** (Mett. ex Ettingsh.) Adams & Alston, comb. nov.

Aspidium speciosum Mett. ex Ettingsh., Farnkr.: 180, t. 106 fig. 12, t. 109 fig. 10, t. 110 fig. 8 (1865).—Mett. in Kuhn, Fil. Afr.: 142 (1868).

Ctenitis fraterna Tard., tom. cit.: 342 (1952) excl. syn.

COLONY. *Eastern Province*: I. Puso Puso ravine, Atewa range, *Adams 79* (GC), *506* (GC), *1187* (GC), *1454* (BM; GC). Near Potroasi, near Kibi, *Adams 157* (BM; GC).

A rare fern of path-side banks and roadsides in the wettest parts of the forest.

TECTARIA Cav.

Tectaria angelicifolia (Schumach.) Copel. in Philipp. Journ. Sci. ii, C: 410 (1907).

Polypodium angelicaefolium Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 228 (1829).

Phegopteris angelicaefolia (Schumach.) Mett. ex Kuhn, Fil. Afr.: 121 (1868).

Polypodium cameroonianum sensu Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898); non Hook.

Aspidium cicutarium sensu Irvine, Pl. G.C.: 42 (1930); non Sw.

COLONY. *Western Province*: I. Basakeh, near Axim, *Cudjoe 46* (GC; K; P). IV. Asin–Nyankumasi, *Cummins 94* (K). Asuansi, *Box 2039* (BM; GC), *2048* (BM; GC), *2436* (BM; GC). Agona–Mankrong, *Vanderpuye 1 & 3* (GC). *Eastern Province*: I. Birim River, Anyinam, *Obeng 9* (GC; K). Bunsu, *Foote 112* (GC); *Cudjoe 83* (GC). Asiakwa, *Adams 82* (BM; GC). Begoro, *Adams 430* (GC). II. Akwapim, *Thonning* (ex Schumach.). Afwerase Hills, Aburi, *Obeng 9A* (GC). Near Adaiso, *Adams 223* (BM; GC). III. Chenedom, *Thomas D56* (GC; K).

ASHANTI. II. Bompata, *Vigne 2706* (FHK; K). Agogo, *Foote 106* (BM; GC). III. Amentia, *Irvine 464* (K). Pra River, near Prasu, *Fishlock 46* (K). IV. Mampong, *Vigne 4103* (FHK; GC; K).

Common throughout the forest; a conspicuous member of the field layer in cocoa farms.

Tectaria buchholzii (Kuhn) Copel. in Phil. Journ. Sci. xxxviii: 138 (1929).

Aspidium buchholzii Kuhn in Deck., Reis. Ost-Afr. iii, 3, Bot.: 47 (1879).

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K). Mielialuma, Basakeh, near Axim, *Cudjoe 108* (BM; GC).

WITHOUT LOCALITY. *Plumptre 85* (K ?, not found).

This fern is apparently rare and local in the south-western Gold Coast.

Tectaria fernandensis (Bak.) C. Chr., Index Fil., Suppl. iii: 179 (1934).

Polypodium fernandense Bak. in Ann. of Bot. v: 462 (1891).

COLONY. *Western Province*: II. Near Enchi, *Adams 2181* (GC). III. Afao Hills F.R., *Adams 2046* (GC). *Eastern Province*: I. Begoro?, *Irvine 1166* (GC). Begoro, *Adams 244* (BM; GC), *454* (GC). Puso Puso ravine, Atewa range, *Box 3259* (BM; GC); *Adams 318* (BM; GC), *336* (BM; GC), *338* (BM; GC). Near Asiakwa, *Adams 188* (BM; GC), *190* (GC). Apapam, near Kibi, *Adams 968* (GC; P; US). Chapiasi, near Kibi, *Adams 1196* (GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3374* (GC). Near Vane, *Adams 984* (GC).

ASHANTI. II. Merishe, near Adiembra, *Kitson 1220* (K). III. Bekwai–Manso Nkwanta road, *Box 2911* (BM; GC).

Not uncommon in the hilly districts in shaded places.

ATHYRIOIDEAE

DIPLAZIUM Sw.

Diplazium hylophilum (Hieron.) C. Chr., Index Fil.: 233 (1905).

Asplenium hylophilum Hieron. in Engl., Pflanzenw. Ost-Afr. C: 84 (1895).

COLONY. *Eastern Province*: I. Puso Puso ravine, Atewa range, *Box 3263* (GC); *Adams 75* (BM; GC), *406* (GC), *505* (BM; GC; K; P).

Recorded only from this locality. In deep shade near a permanent stream at 360 m. altitude.

Diplazium proliferum (Lam.) Kaulf., Enum. Fil.: 182 (1824).

Asplenium proliferum Lam. in Encycl. Méth., Bot. ii: 307 (1786).—Kuhn, Fil. Afr.: 112 (1868).
Diplazium incisum Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 232 (1829).
Diplazium serratum Schumach., tom. cit.: 233 (1829).
Asplenium sylvaticum sensu Chipp, List Herb. Pl. G.C.: 40 (1914); non C. Presl.
Diplazium silvaticum sensu Irvine, Pl. G.C.: 164 (1930); non Sw.

COLONY. *Western Province*: IV. Near Asuansi, *Box 2045* (BM; GC), *2858* (BM; GC). Kakum F.R., near Krua, *Box 2914* (BM; GC). *Eastern Province*: I. Kibi, *Johnson 244* (GC; K). Begoro, *Irvine 1170* (GC). Near Oda, *Box 2886* (BM; GC). Puso Puso ravine, Atewa range, *Scholes 449* (BM; GC). Tafo?, *Darko 164* (GC). Near Asiakwa, *Adams 187* (GC). Bunsu, *Cudjoe 80* (GC). II. Akwapim, *Thonning* (C, type of *D. incisum*). Akwapim?, *Thonning* (ex Schumach., type of *D. serratum*).

ASHANTI. I. Fwirem, *Chipp 455* (FHK; K). II. Merishe, near Adiembra, *Kitson 1221* (K). Near Bompata, *Vigne 2716* (FHK; GC; K). Juaso, *Akpabla 238* (GC; K). Bobiri F.R., *Adams 543* (GC; K; P; US). III. Amentia, *Irvine 439* (K).

Common in low-lying swampy places in the forest.

Diplazium sammatii (Kuhn) C. Chr., Index Fil.: 238 (1905).

Asplenium sammatii Kuhn in Decken, Reise Ost-Afr. iii, 3, Bot.: 34 (1879).

COLONY. *Western Province*: I. Basakeh, near Axim, *Cudjoe 17* (GC). II. Neung F.R., near Tarkwa, *Cudjoe 27* (GC; K; P; US). IV. Kakum River, Asuansi, *Box 2055* (BM; GC), *2881* (BM; GC); *Adams 118* (BM; GC).

Local on the sandy banks of sluggish streams in the forest.

Diplazium welwitschii (Hook.) Diels in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 226 (1899).

Asplenium welwitschii Hook. in Hook. & Bak., Synops. Fil.: 235 (1867).

COLONY. *Eastern Province*: I. Puso Puso ravine, Atewa range, *Adams 90* (BM; GC), *94* (GC), *412* (BM; GC; K; P; US). Potroasi, near Kibi, *Adams 158* (BM; GC).

ASHANTI. II. Bobiri F.R., *Adams 528* (GC).

Rare in damp shady places in the forest.

ADIANTACEAE

GYMNOGRAMMOIDEAE

CERATOPTERIS Brongn.

Ceratopteris cornuta (Beauv.) Lepr. in Ann. Sci. Nat. xix: 103, t. 4 A (1830).

Pteris cornuta Beauv., Fl. Oware & Benin i. 63: t. 37 fig. 2 (1809).
Ceratopteris thalictroides sensu Irvine, Pl. G.C.: 95 (1930); non Brongn.

COLONY. *Western Province*: IV. Asuansi, *Box 2044* (BM; GC); *Scholes 197* (GC). Fanti-Nyankumasi, *Scholes 281* (GC). *Eastern Province*: I. Near Oda, *Box 2932* (BM; GC). II. Aburi?, *Howes 1125* (GC). Aburi, *Irvine 1002* (GC).

ASHANTI. I. Fuller Falls, near Kintampo, *Adams 578* (GC).

WITHOUT LOCALITY. *Darko* (GC).

Occasional in streams and pools in open places mainly in the forest area.

PITYROGRAMMA Link

Pityrogramma calomelanos (L.) Link, Handb. Erkenn. Gewächs. iii: 20 (1833) (err. typogr. *calomelas*).

Acrostichum calomelanos L., Sp. Pl. ii: 1072 (1753).
Ceropteris calomelanos (L.) Underw. in Bull. Torr. Bot. Club xxix: 632 (1902).—Irvine, Pl. G.C.: 96 (1930).

COLONY. *Western Province*: I. Ancobra River, Axim, *Irvine 2142* (GC; K). Axim, *Foote 121* (GC). Benyimade, near Axim, *Cudjoe 14* (GC; K), *39* (GC; P; US). II. Tarkwa, *Vigne 4119* (FHK; GC). Prestea, *Cudjoe 30* (GC). IV. Asuansi, *Box 2054* (BM), *2875* (BM). Abura Dunkwa, *Box 2061* (BM; GC). Agona–Mankrong, *Vanderpuye 11* (GC). *Eastern Province*: I. Brenase, *Irvine 551* (GC; K). Juaso, Atewa range, *Todd* (GC). II. Achimota (cultivated), *Irvine 2113* (GC). Aburi, *Obeng 11* (GC).

ASHANTI. II. Merishe, near Adiembra, *Kitson 1222* (K). Bompata, *Vigne 2717* (FHK; K). III. Obuasi, *Vigne* (*coll. Andoh*) *4215* (FHK; K).

Common in roadside ditches and by streams in the forest.

Though this species is common it has undoubtedly been introduced at some time and never forms part of the natural vegetation. It is rarely found far from roads, farms or habitations. It is a native of tropical America but is now widespread in the Old World.

ADIANTUM L.

Adiantum caudatum L., Mant. Pl. Alt.: 308 (1771).

COLONY. *Eastern Province*: III. Bame Pass, *Adams & Akpabla 4001* (BM; GC; K; P; US). Krobo Hill, *Akpabla* (GC).

SOUTHERN TOGOLAND. I. Kpandu, *Asamany 145* (GC; K).

ASHANTI. I. Fuller Falls, near Kintampo, *Adams 589* (GC).

On sandy or rocky banks in the dry marginal forest area.

Adiantum confine Fée, Mém. Fam. Foug. x: 14, t. 32, fig. 1 (1865).

COLONY. *Eastern Province*: I. Nkwantanang, near Abetifi, *Scholes 124* (BM; GC). III. Peki, *Scholes 136* (GC). Labolabo, *Scholes* (GC). Volta River F.R., *Adams 369* (BM; GC), *991* (GC; P; US).

SOUTHERN TOGOLAND. I. Akpafu, *Scholes 35B* (GC).

ASHANTI. II. Agogo, *Adams 2581* (GC).

Rare in leafy soil overlying rocks in the dry forest area.

Adiantum philippense L., Sp. Pl. ii: 1094 (1753).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3376* (GC; K). Akpafu, *Scholes 35A* (BM; GC).

ASHANTI. I. Fuller Falls, near Kintampo, *Adams 580* (GC). Saunders' Fall, near Kintampo, *Adams 963* (GC). II. Juaso, *Irvine 2825* (GC). IV. Mampong, *Adams & Akpabla 4533* (BM; GC).

NORTHERN TERRITORIES. I. Near Damongo, *Adams 959* (GC; P; US). IV. Bongo, *Cudjoe 102* (GC).

Locally abundant in shady rocky places on very well-drained soil in the more northerly and drier parts of the forest.

Adiantum soboliferum Wall. [Numer. List: 4, n. 74 (1829), *nom. nud.*] ex Hook., Sp. Fil. ii: 13, t. 74 A (1851).

COLONY. *Eastern Province*: III. Bana Hill, Krobo, *Irvine 2880* (GC).

SOUTHERN TOGOLAND. I. Fume, *Morton* (GC).

ASHANTI. II. Lake Bosumtwe, *Box 2900* (BM; GC); *Adams 97* (GC), *99* (GC), *540* (GC; K; P; US); *Adams & Akpabla 4541* (GC).

Rare and local in shaded well-drained places on steep slopes in the forest.

Adiantum vogelii Mett. ex [Kuhn, Fil. Afr.: 66 (1868), *nom. synon.*] Keys. in Mém. Acad. Imp. Sci. St.-Pétersb., Sér. 1, xxii, 2: 8, 31 (1875).

Adiantum tetraphyllum sensu Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898).—Chipp, List Herb. Pl. G.C.: 39 (1914); non Humb. & Bonpl. ex Willd.

Adiantum hispidulum sensu Irvine, Pl. G.C.: 10 (1930); non Sw.

COLONY. *Western Province*: I. Basakeh, near Axim, *Cudjoe 16* (GC). II. Neung

F.R., Tarkwa, *Cudjoe 23* (GC; K; P; US). IV. Asin–Nyankumasi, *Cummins 85* (K). Sapawni, Pra River, *Johnson 995* (GC; K). Asuansi, *Box 2031* (BM; GC); *Scholes 157* (GC). Agona–Mankrong, *Vanderpuye 2* (GC). *Eastern Province*: I. Anyinam, *Obeng 6* (GC; K). Bunsu, *Foote 120* (GC); *Cudjoe 77* (GC). Nkwantanang, near Abetifi, *Scholes 125* (BM; GC). Oda, *Box 2483* (BM: GC). Puso Puso ravine, Atewa range, *Adams 73* (GC). Asiakwa, *Adams 198* (GC), *420* (GC). Kukurantumi, *Adams 251* (BM; GC). II. Aburi, *Johnson 201* (GC). Mampong, *Box 2090* (BM; GC). III. Dawa Mate Kole, *Thomas D31* (GC; K). Boti, near Huhunya, *Adams 277* (GC), *286* (GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3379* (GC).

ASHANTI. II. Bompata, *Vigne 2705* (FHK). Konongo, *Akpabla 261* (GC; K). Agogo, *Foote 100* (GC). Lake Bosumtwe, *Box 2897* (BM; GC); *Adams 96* (GC), *100* (GC). III. Amentia, *Irvine 462* (K). IV. Mampong, *Vigne 4100* (FHK; K).

WITHOUT LOCALITY. *Farmar 443* (K); *Fishlock 43* (K).

Throughout the forest in various shade habitats.

PELLAEA Link

Pellaea doniana Hook., Sp. Fil. ii: 137, t. 125 A (1858).

COLONY. *Eastern Province*: I. Akantin, *Vigne 4042* (FHK; GC; K). Abetifi–Abene road, *Scholes 114* (GC). Near Begoro, *Adams 450* (GC). II. Achimota (cultivated), *Irvine 2589* (GC). Aburi, *Obeng 27* (GC; K); *Adams 208* (GC). Larte road, *Box 2093* (BM; GC). Nsawam–Aburi road, *Box 2877* (BM; GC). Near Mamfe, *Adams 302* (GC). III. Peji Hill, Anum, *Adams 143* (GC; K). Boti, near Huhunya, *Adams 285* (GC). Volta River F.R., near Odumase, *Adams 371* (GC), *993* (GC). Odumase, *Box 2929* (BM; GC).

SOUTHERN TOGOLAND. I. Kpandu, *Adams 1794* (GC).

ASHANTI. I. Fuller Falls, near Kintampo, *Adams* 584 (GC). II. Lake Bosumtwe, *Box 2898* (BM; GC); *Adams* 98 (GC).

Common along roadsides and among rocks in shade in the drier parts of the forest.

DORYOPTERIS J.Sm.

Doryopteris concolor (Langsd. & Fisch.) Kuhn in Decken, Reise Ost-Afr. iii, 3, Bot.: 19 (1879).

Pteris concolor Langsd. & Fisch., Ic. Fil.: 19, t. 21 (1810).
Pteris geraniifolia Raddi, Opusc. Sci. Bologna iii: 293 (1819).
Adiantum palmatum Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 234 (1829).
Pellaea geraniifolia (Raddi) Fée, Mém. Fam. Foug. v: 130 (1852).—Chipp, List Herb. Pl. G.C.: 40 (1914).

COLONY. *Eastern Province*: II. Akwapim, *Thonning* (ex Schumach.). Aburi, *Johnson 10 & 11* (GC); *Irvine 63* (GC). Akropong, *Irvine 2597* (K). Mampong, *Box 2091* (BM; GC). III. Peji Hill, Anum, *Adams 142* (GC; K). Boti, near Huhunya, *Adams 284* (GC). Volta River F.R., near Odumase, *Adams 370* (GC), *992* (GC; P; US).

SOUTHERN TOGOLAND. I. Kpandu, *Adams 1797* (GC).

ASHANTI. II. Agogo, *Foote 51* (BM; GC). Lake Bosumtwe, *Box 2901* (BM; GC).

Frequent on leafy soil overlying rocks in shade in the drier parts of the forest.

Doryopteris nicklesii Tard. in Notul. Syst. xiii: 166 (1948).

COLONY. *Eastern Province*: I. Near Bosuso, *Adams 463* (BM; GC). III. Near Odumase, Manya Krobo, *Adams 477* (GC). Near Otrokpe, *Adams 566* (GC).

ASHANTI. I. Near Mampong, *Box 2931* (BM; GC).

Local in sandy soil by paths and roads in hilly parts of the dry forest country.

VITTARIOIDEAE

VITTARIA Sm.

Vittaria guineensis Desv. in Mag. Ges. Naturforsch. Freunde Berl. v: 325 (1811).

Vittaria lineata sensu Cummins in Bull. Misc. Inf. Kew 1898: 81 (1898); non Sm.

COLONY. *Western Province*; IV. Asuansi, *Box 2064* (BM; GC). *Eastern Province*: I. Assene, *Foote 127* (GC). Near Nkawkaw, *Box 3458* (BM; GC). Near Begoro, *Adams 449* (GC). Awaham, *Adams 520* (GC; K; P). Apapam, near Kibi, *Adams 980* (GC). II. Aburi, *Johnson 211* (GC); *Irvine 2790* (GC); *Adams 179* (GC), *986* (GC; US).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3398* (GC).

ASHANTI. I. Near Mampong, *Box 2905* (BM; GC). Fuller Falls, near Kintampo, *Adams 583* (GC). II. Agogo, *Foote 55* (GC). III. Pra–Anum F.R., *Box 2924* (BM; GC).

Not uncommon as an epiphyte on tree-trunks, particularly oil-palms, in the forest.

Vittaria owariensis Fée, Mém. Fam. Foug. iii: 21, t. 3, fig. 2 (1852).

COLONY. *Western Province*: IV. Asuansi, *Box 2064A* (BM; GC). *Eastern Province*: II. Aburi Hills, *Johnson 300* (K).

Similar in habitat to the last but much less common; perhaps often overlooked.

MARSILEACEAE

MARSILEA L.

Marsilea diffusa Lepr. ex A. Braun in Flora xxii, 1: 300 (1889).

COLONY. *Eastern Province*: II. 24 km. on Accra–Dodowah road, *Scholes 135* (BM; GC). Achimota (cultivated), *Akpabla 936* (BM; GC), *943* (GC). 25 km. on Accra–Ada road, *Adams 175* (BM; GC), *493* (GC). Near Dawa, Accra Plains, *Adams 436* (BM; GC; K).

NORTHERN TERRITORIES. II. 64 km. on Yendi–Tamale road, *Adams & Akpabla 4139* (BM; GC). III. Burufo, near Lawra, *Adams & Akpabla 4378* (BM; GC). IV. 3 km. on Walewale–Gambaga road, *Adams & Akpabla 4202* (BM; GC).

Not uncommon in seasonal ponds in open country.

Marsilea fimbriata Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 235 (1829).—A. Braun in Monatsber. K. Preuss. Akad. Wiss. Berl. 1863: 432 (1864).

WITHOUT LOCALITY. *Thonning* (ex Schumach.).

An imperfectly known species which is, according to Braun's definition, distinguished by its solitary sessile sporocarps.

Marsilea polycarpa Hook. & Grev., Ic. Fil. ii: t. 160 (1830).

NORTHERN TERRITORIES. III. Burufo, near Lawra, *Hinds 5007* (K); *Adams 943* (BM; GC; K; P; US).

In muddy pools overlying laterite, desiccated in dry season.

It would seem that this species is confined to the specialized habitat of markedly seasonal pools on the flat tops of laterite plateaux. These pools are very shallow and occur in the slight depressions of the impervious ironstone platform. Sterile specimens, which are probably referable to the same species, have been found in a similar habitat in the Anara F.R., Igabi, Zaria, in Northern Nigeria (*Keay FHI. 25962*).

Although strictly annual in the natural environment, this plant, like *M. diffusa*, continues to propagate vegetatively in cultivation so long as adequate moisture is provided.

SALVINIACEAE

SALVINIA Adans.

Salvinia nymphellula Desv. in Mém. Soc. Linn. Par. vi: 177 (1827).

COLONY. *Eastern Province*: IV. 5 km. from Tefle junction on Viume road, *Foote 1003* (BM; GC). Near Kpotame on Tefle road, *Adams 442* (BM; GC; K; P).

Floating, or on mud among sedges and grasses at pond margins in open country. Local.

AZOLLA Lam.

Azolla africana Desv. in Mém. Soc. Linn. Par. vi: 178 (1827).

Azolla guineensis Schumach. in Kongel. Dansk. Vid. Selsk. Naturvid. & Math. Afh. iv: 236 (1829).

COLONY. *Eastern Province*: I. Achiasi, near Oda, *Box 2920* (BM; GC). II. Achimota (cultivated), *Akpabla 1125* (GC). 25 km. on Accra–Ada road, *Adams 983* (GC; P; US).

WITHOUT LOCALITY. *Thonning* (ex Schumach.).

Floating on seasonal ponds. Local and sporadic; occasionally abundant.

LYCOPODIINAE

LYCOPODIACEAE

LYCOPODIUM L.

Lycopodium cernuum L., Sp. Pl. ii: 1103 (1753).—Chipp, List Herb. Pl. G.C.: 41 (1914).

COLONY. *Western Province*: I. Axim, *Johnson 990* (GC; K). Abra, near Axim, *Box 2872* (BM; GC). Brawile, near Axim, *Cudjoe 4* (GC; K; P; US). Axim–Agona junction road, *Cudjoe 54* (GC). Bonyere, near Axim, *Cudjoe 56* (GC). II. Tarkwa, *Vigne 4126* (FHK). Subri River F.R., *collector unknown* (FHK 5243). *Eastern Province*: I. Near Kibi, *Irvine 1831* (GC; K). Osino, *Obeng 15* (GC; K). Oda, *Box 2063* (BM; GC). Potroasi, near Kibi, *Adams 161* (GC).

SOUTHERN TOGOLAND. I. Biakpa, near Amedjofe, *Irvine 3391* (GC).
ASHANTI. II. Kumasi, *Irvine 91* (GC; K).
On roadside and path-side banks and cuttings in the wet forest.

Lycopodium staudtii (Nessel) Adams & Alston, comb. nov.

Lycopodium phlegmaria sensu Chipp, List Herb. Pl. G.C.: 41 (1914); non L.
Lycopodium adolfi-friderici Herter ex Mildbr. in Wiss. Ergebn. Zweit. Deutsch. Z.-Afr.-Exped. ii: 160 (1922), *nom. nud.*
Urostachys staudtii Nessel in Fedde, Repert. Sp. Nov. xxxvi: 189, t. 175 (1934).
Urostachys adolfi-friderici Herter ex Nessel [Bärlappgew.: 226 (1939) (*adolfi friedericii*) *sine diagn. lat.*] in Rev. Sudamer. Bot. vi: 167, t. 13 fig. 66 (1940).

COLONY. *Eastern Province*: I. Kankang, *Johnson 674* (K). Worobong F.R., *Vigne 4314* (FHK).
ASHANTI. II. Namong, near Ofinso, *Cox* (GC). Bobiri F.R., *Adams 537* (GC).
WITHOUT LOCALITY. *Fishlock 83* (GC).
A pendent epiphyte on the high branches of tall trees in the forest. Rare.

SELAGINELLACEAE

SELAGINELLA Beauv.

Selaginella buchholzii Hieron. in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 696 (1901); in Hedwigia xliii: 51 (1904).

ASHANTI. IV. Ejura scarp, *Adams & Akpabla 4525* (BM; GC; K).
Growing in damp coarse sand in cracks between horizontal rock strata. Rare.

Selaginella cathedrifolia Spring in Mém. Acad. R. Belg. xxiv: 112 (1850).—Oliv. in Burton & Cameron, To the G.C. for Gold ii: 371 (1883).—Chipp, List Herb. Pl. G.C.: 41 (1914).

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K). Tomento–Ancobra, *Johnson 987* (GC; K). Axim, *Cudjoe 76* (BM; GC; P; US). II. Bonsa–Tarkwa road, *Johnson 988* (GC; K), *989* (GC; K).
SOUTHERN TOGOLAND. I. Kpeme Hill, near Ahenkro, *Adams 1813* (BM; GC).
WITHOUT LOCALITY. *Fishlock 45* (K).
On roadside banks in the wet forest. Local.

Selaginella molliceps Spring in Mém. Acad. R. Belg. xxiv: 257 (1850).

Selaginella zechii Hieron. in Eng. & Prantl, Nat. Pflanzenfam. i, 4: 697 (1901).

COLONY. *Western Province*: I. Near Prince's Town, *Cudjoe 94* (GC). II. Mpesem F.R., near Prestea, *Cudjoe 36* (GC; K; P; US). IV. Foso–Juaso F.R., *Box 2487* (BM; GC); *Scholes 251* (BM). Kakum F.R. near Nfuom, *Box 2855* (BM), *2862* (BM; GC), *2919* (BM; GC), *2935* (BM; GC). Kakum F.R., near Krua, *Box 2915* (BM; GC). *Eastern Province*: I. Kibi, *Johnson 506* (GC; K); *Box 3506* (BM). Puso Puso ravine, Atewa range, *Box 3256* (BM; GC); *Adams 418* (GC), *497* (GC). Potroasi, near Kibi, *Adams 183* (BM; GC). Near Asiakwa, *Adams 421* (GC). II. Aburi, *Thompson* (BM).
SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3356* (GC). II. Krachi, *Zech 388* (B).
ASHANTI. III. Near Fomena, *Box 2912* (BM; GC).

WITHOUT LOCALITY. *Johnson 216* (GC); *Foote 49* (BM); *Irvine 3537* (BM).

Not uncommon on rocks or roadside and path-side banks in wet shady places in the forest.

Selaginella myosurus (Sw.) Alston in Journ. of Bot. lxx: 64 (1932).

Lycopodium myosurus Sw. in Schrad., Journ. Bot. 1800, 2: 118 (1801).
Stachygynandrum scandens Beauv., Fl. Oware & Benin i: 10, t. 7 (1805).
Selaginella scandens (Beauv.) Spring in Bull. Acad. Brux. x, 1: 226 (1843).—Chipp, List Herb. Pl. G.C.: 41 (1914).—Irvine, Pl. G.C.: 381 (1930).

COLONY. *Western Province*: I. Axim, *Johnson 991* (GC; K), *Chipp 415* (FHK; K); *Akpabla 105* (GC; K); *Foote 122* (GC); *Joly* (P). Atuabo, *Fishlock 44* (K). Near Esiama, *Fishlock 87* (K). Esiama, *Fishlock 110/111* (GC; K); *Plumptre* (GC). Axim–Esiama road, *Plumptre* (GC). Dixcove, *Box 2074* (BM; GC). Brawile, near Axim, *Cudjoe 6* (GC; K; P; US). II. Tarkwa, *Vigne 4125* (FHK). IV. Asin–Nyankumasi, *Cummins* (K). Abura Dunkwa, *Box 2062* (BM; GC). *Eastern Province*: I. Brenase, *Irvine 552* (K). II. Aburi, *Obeng 18* (GC; K); *Adams 181* (GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3373* (GC).

ASHANTI. III. Near Fomena, *Adams 2498* (GC).

WITHOUT LOCALITY. *Johnson 213* (GC).

Scrambling and twining among small shrubs or on roadside banks in wet parts of the forest, especially in clearings.

Selaginella versicolor Spring in Bull. Acad. Brux. x, 1: 143 (1843).

Selaginella sp. nr. *anceps*.—Oliv. in Burton & Cameron, To the G.C. for Gold, ii: 371 (1883).

COLONY. *Western Province*: I. Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K). Axim, *Cudjoe 74* (GC). II. Simpa, *Vigne 2915* (FHK). Neung F.R., near Tarkwa, *Cudjoe 34* (GC; P; US). *Eastern Province*: I. Kibi, *Johnson 259/248* (GC; K). Bunsu, *Foote 129* (GC); *Thompson* (BM). Near Begoro, *Box 2949* (BM; GC). Puso Puso ravine, Atewa range, *Box 3257* (BM; GC); *Adams 72* (BM; GC), *89* (BM; GC), *409* (GC; K). Near Asiakwa, *Adams 191* (GC).

SOUTHERN TOGOLAND. I. Amedjofe, *Irvine 3357* (GC).

ASHANTI. IV. Ninting Hill, Mampong, *Box 2904* (BM; GC).

An epiphyte on the trunks of trees and tree-ferns, and on rocks in very damp shady places in the forest.

Selaginella vogelii Spring in Mém. Acad. R. Belg. xxiv: 170 (1850).—Oliv. in Burton & Cameron, To the G.C. for Gold ii. 371 (1883).—Chipp, List Herb. Pl. G.C.: 41 (1914).—Irvine, Pl. G.C.: 381 (1930).

COLONY. *Western Province*: I. Axim, *Joly* (P). Prince's River (Yenna or Nyan R.?), *Burton & Cameron* (K?, not found). II. Neung F.R., near Tarkwa, *Cudjoe 18* (GC; K; P; US). IV. Near Fanti–Nyankumasi, *Box 2073* (BM; GC). Kakum F.R., near Nfuom, *Box 2861* (BM; GC). *Eastern Province*: I. Anyinam, *Obeng 4* (GC; K). Abetifi, *Tschopp* (K). Puso Puso ravine, Atewa range, *Box 3258* (BM); *Adams 91* (GC). Potroasi, near Kibi, *Adams 165* (BM; GC). II. Akropong, *Brown 332* (K). Koforidua, *Johnson 267* (GC; K). Mampong, *Johnson 580* (GC; K).

ASHANTI. II. Kumasi, *de Hoghton* (K). Konongo, *Akpabla 254* (GC; K). III. Banka, *Irvine 480* (K). Between Nkwanta and Sikamang, *Kitson 1246* (K).

WITHOUT LOCALITY. *Winwood Reade* (K); *Fishlock* (K); *McAinsh 873* (K); *Greene* (K).

Terrestrial in damp shady places in the forest. Widely distributed.

PSILOPHYTINAE

PSILOTACEAE

PSILOTUM Sw.

Psilotum nudum (L.) Griseb. in Abhandl. K. Ges. Wiss. Götting. vii, Phys. Cl.: 278 (1857).

Lycopodium nudum L.Sp. Pl. ii: 1100 (1753).

COLONY. *Eastern Province*: II. Near Aburi, *Johnson 214* (GC).

Apparently very rare.

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SOME
HIMALAYAN FUNGI

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SOME HIMALAYAN FUNGI

By FRANCES L. BALFOUR-BROWNE

THE fungi described below were collected during the plant-hunting expeditions detailed as follows: 1938, F. Ludlow, G. Sherriff and G. Taylor in the Tibetan provinces of Kongbo and Takpo in the lower Tsangpo valley between Molo and the great bend of the Tsangpo river; 1947, F. Ludlow, G. Sherriff and H. H. Elliot in the provinces of of Kongbo and Pome, an area farther to the north-east of that visited by the 1938 expedition; 1949, F. Ludlow, G. Sherriff and J. H. Hicks in Bhutan; 1952, O. Polunin, W. R. Sykes and L. H. J. Williams in Nepal, mainly in the eastern part of the province of Jumla at heights varying from 1,800 to 5,400 metres.

Fungi have only rarely been recorded from Tibet, Nepal or Bhutan and our knowledge of the mycology of the neighbouring regions of Sikkim and the Khasi Hills is largely due to the collections made by Sir Joseph D. Hooker in 1849–1850, during his survey of the flora of India, and to A. Barclay, who began to collect and study the life-histories of rusts, especially those from Simla. Since then but little has been recorded from the Himalayas, whereas there is a considerable literature, scattered among hundreds of papers, on the mycology of peninsular India and of Burma and Ceylon. In 1931 E. J. Butler and G. R. Bisby published *The Fungi of India*, a compilation of this literature and an enumeration of the fungi recorded to that date.

In the account which follows, the species of the *Clavariaceae* have been identified by E. J. H. Corner, to whom I am most grateful. He has also determined some species of *Lactarius*, *Clitocybe* and *Pleurotus*. Each description or note for which he is responsible is indicated by his initials in parenthesis.

As the primary objective of all four expeditions was the collection of phanerogamous plants the fungi were, for the most part, only picked up incidentally with no attempt at intensive collection. Nevertheless, Williams and his colleagues in Nepal succeeded in bringing home 87 specimens representing 79 species. The Tibetan fungi include 56 species, whereas only 7 were taken in Bhutan.

A number of the specimens in the collections studied have proved to be difficult to identify owing to over-pressing; this is particularly the case with the species of *Clavaria* and the Agarics from Nepal. The best results are to be obtained by light pressure and rapid drying, an ideal which, it is appreciated, is difficult to obtain in the field.

Since, as already indicated, the mycological flora of the Himalayan area is still very inadequately known, it is premature to discuss the relationships of the flora and the nature of the distribution of many of the species. Evidence is often quite insufficient to show whether a species previously only known from another part of the world is native or introduced accidentally with horticultural or economic plants or seeds. Even the natural distribution of fungi (as distinct from the artificial introduction) is a complex problem governed by the interaction of many factors, including not only the nutritional, climatic, edaphic and biotic but also the special one of the dissemination of countless microscopic spores.

HYMENOMYCETES

Clitocybe diatreta Fr., Syst. Myc. i: 83 (1821).

NEPAL: Suli Gad, below Lulo Khola, 4,200 m.; in leaf soil of coniferous forest; 16 Sept. 1952, *Polunin, Sykes & Williams 3456*.

Distribution: Europe and Nepal. The present representatives do not differ in any particular from the European form and, like them, often have their stem bases balled up with the needles of coniferous trees.

Clitocybe infundibuliformis (Fr.) Quél., Champign. Jura & Vosges: 52 (1872).

Agaricus infundibuliformis Fr., Epicr. Syst. Myc.: 68 (1836).

NEPAL: Suli Gad, below Lulo Khola, 4,000 m.; in humus in coniferous forest; 16 Sept. 1952, *Polunin, Sykes & Williams 3459*.

Distribution: America, Europe, N. Africa and Nepal.

Pileus up to 3 cm. wide, infundibuliform, dry, smooth, 'brown': stem 3·5 cm. × 3–6 mm., 'very pale fawn': gills deeply decurrent, not anastomosing, crowded, 'white': spores 5–7 × 4·3–5 μ, lacrymiform, very thin-walled, not amyloid: basidia 25–30 × 7 μ, sterigmata 4: cystidia none: hyphae up to 18 μ wide, clamped, inoderm on the pileus and 5–8 μ wide, without pileocystidia or caulocystidia, the cells rather short, up to 150 μ long in the stem, but not secondarily septate.

Except for the slightly wider spores, there is no difference from the deeper coloured forms of *C. infundibuliformis*. (E. J. H. C.)

Favolus sp. aff. **multiplex** Lév. in Ann. Sci. Nat. Sér. 3, Bot. xii: 203 (1844).

S.E. TIBET: Pome, Tongkyuk Dzong, 2,850 m.; 1 Jan. 1947, *Ludlow, Sherriff & Elliot 12058*.

This fungus appears to be close to *F. multiplex* Lév., but its poor state of preservation makes identification uncertain. It is irregularly flabelliform, lobed, orange to ferruginous, of a fleshy, coriaceous texture when wet; brittle and semi-transparent when dry. The pileus surface is slightly rough with radiating striae. Pores are shallow, unevenly hexagonal to elongated and lacerated. Spores are hyaline, oval to elliptical, 2 × 4 μ.

Pleurotus nepalensis Corner, sp. nov.

P. ostreati affinis, sed cystidiatus et sporis angustioribus (an incarnatis ?).

Pileus ad 10 × 13 cm., applanatus, flabelliformis vel reniformis, primo spathulatus, laevis sed basim versus villoso-subfurfuraceus, pallide brunneolus, sicco cervicolor, margine tenui, paullum incurvato: stipite 1·5–2·5 × 1·5–3 cm., laterali, breviter villoso: lamellis decurrentibus, ad stipitem subanastomosis, confertis, ordinibus numerosis, c. 3–4 mm. latis, acie integro, cremeis: carne ut in *P. ostreato*: sporis 5–6 × 1·5–2 μ, hyalinis, suballantoideis, haud amyloideis, 2-guttulatis: basidiis tetrasporis:

cystidiis 35–70×9–15 μ, superficie lamellae et acie dispersis, projicientibus, tenuiter tunicatis, laevibus, clavatis vel ventricosis, interdum breviter appendiculatis: hyphis ad 20 μ latis, fibulatis, in lamellis tenuiter tunicatis, in pileo et in stipite tunicis 1–2 μ incrassatis, haud gelatinosis, pilei superficie applanatus 3–6 μ latis.

NEPAL: Dhotbas, near Chakure Lekh, 3,000 m.; on dead tree trunk in *Tsuga*-forest; 12 Oct. 1952, *Polunin, Sykes & Williams 5564*. (Herb. Brit. Mus., holotype).

Distribution: known only from Nepal. (E. J. H. C.)

Gomphus floccosus (Schwein.) Singer in Lloydia viii: 140 (1945).

Cantharellus floccosus Schwein. in Trans. Amer. Phil. Soc., New Ser. iv: 153 (1832).

Forma **floccosus**.

Pileus up to 10 cm. high, 8 cm. wide, apparently without scales, infundibuliform, 'bright orange': stem 5–8×1·5–2 cm., solid, 'pink at the base': hymenium with radial, anastomosing, subdistant folds –1·5 mm. deep, forming elongate meshes 5–20 mm. long, not regularly dichotomous, 'pale yellow': spores 14–21×7–10 μ, pale ochraceous, minutely rough: hyphae 3–25 μ wide, without clamps.

The spores are wider than usual for *G. floccosus*.

NEPAL: Ratamata, Chakure Lekh, 3,300 m.; in humus in *Abies-Betula* forest; 12 Aug. 1952, *Polunin, Sykes & Williams 395*.

Distribution: hitherto known from N. America, China (Yunnan) and Japan, as a species in coniferous forests. (E. J. H. C.)

Forma **excavatus** Sm. & Morse in Mycologia xxxix: 525, figs. 7 & 8 (1947).

Pileus up to 10×4 cm. overall, narrowly infundibuliform, pervious to the base of the stem, wholly 'dull yellow': pileus slightly floccoso-squamulose: stem *c.* 1 cm. wide: hymenium narrowly plicate with crowded, radiating, repeatedly dichotomous folds –1 mm. deep, slightly anastomosing: spores 14–21×6·5–8·5 μ, pale ochraceous, minutely rough: hyphae –12 μ wide, without clamps.

S.E. TIBET: Kongbo, Deyang La, 3,800 m.; on the ground among moss in *Abies*-forest; 7 Aug. 1947, *Ludlow & Sherriff 14440*.

Distribution: N. America and Tibet. (E. J. H. C.)

Craterellus cornucopioides Fr., Epicr. Syst. myc: 532 (1838).

E. BHUTAN: Rocha Chu Valley, Trashiyangsi, 2,740 m.; in moss on ground in dense jungle; 24 Sept. 1934, *Ludlow & Sherriff 977*.

Distribution: cosmopolitan.

Lenzites eximia Berk. in Hook., Journ. Bot. vi: 134 (1854).

S.E. TIBET: Pome, Tongkyuk Dzong, 2,730 m.; on dead trees; 24 Dec. 1946, *Ludlow, Sherriff & Elliot 12034*.

Distribution: Himalayas from Sikkim to S.E. Tibet.

Lenzites subferruginea Berk. in Hook., Journ. Bot. vi: 134 (1854).

Gloeophyllum edule Murr. in Bull. Torr. Bot. Cl. xxxiv: 480 (1907).

NEPAL: Lulo Khola, 3,900 m.; on trunk of fallen tree; 16 Sept. 1952, *Polunin, Sykes & Williams 3445*.

Distribution: previous records are from India, the Phillipines and Japan.

Lenzites sp. aff. **cyclogramma** Pat. in Bull. Soc. Myc. Franc. xxiii: 73 (1907).

S.E. TIBET: Pome, Gyadzong, Yigrong Chu, 2,590 m.; on pine; 23 Jan. 1947, *Ludlow, Sherriff & Elliot 12178*.

This species was described by Patouillard from Tonkin on *Cocos* and resembles a pale form of *Lenzites betulina* Fr. The Tibetan fungus appears to be very close to it but occurs on a different host. Cystidia are abundant but spores have not developed.

Merulius imbricatus Balfour-Browne, sp. nov.

Sporophoris imbricatis, liberis, non-resupinatis, pallide tomentosis; carnoso-tremellosis, sicco membranaceis vel corneis, 5 cm. latis, 15–20 cm. longis: hymenio ochraceo vel vinoso: poris gyrosis, irregularis, ad marginem elongatis et radiatis: trama ex hyphis ochraceis, gelatinosis, ± parallelis, composita: basidiis 4-sterigmatis, cylindraceo-clavatis, 15–18 μ longis, 3–5 μ latis: sporis globosis vel subglobosis, 4 μ diam. vel $4 \times 4{\cdot}5\ \mu$.

S.E. TIBET: Pome, Gyadzong, Yigrong Chu, 2,550 m.; 12 Jan. 1947, *Ludlow, Sherriff & Elliot 12187*. (Herb. Brit. Mus., holotype).

Distribution: known only from S.E. Tibet.

The upper surface is composed of loosely interwoven, hyaline, thick-walled, septate, branching skeletal hyphae which give place to a zone of yellow ± parallel hyphae of slightly wider lumen, septate, branched and having walls which swell considerably in water: the subhymenium consists of thin-walled, septate, branched generative hyphae on which the 4-spored basidia are borne in palisade fashion; clamp connexions occur on all types of hyphae.

This species closely resembles *Merulius tremellosus* Fr. in structure but differs in its entirely non-resupinate habit, in colour and in spore characters.

Hericium caput-ursi (Fr.) Corner, comb. nov.

Hydnum caput-ursi Fr., Monogr. Hym. Suec. ii: 278 (1863).

S.E. TIBET: Kongbo, valley above Sang, 3,150 m.; in wet leaf mould under evergreen oak; 20 June 1938, *Ludlow, Sherriff & Taylor 4988*.

Spores $4{\cdot}7$–$5{\cdot}2$ (–6) $\times$ $3{\cdot}7$–$4{\cdot}3$ (–5) μ, amyloid, smooth. This is the form with elongate branches that has mistakenly been called *H. coralloides* by some authors.

Distribution: cosmopolitan. (E.J.H.C.)

Hydnum erinaceus Fr., Syst. Myc. i: 407 (1821).

S.E. TIBET: Pome, Tongkyuk Dzong, 2,850 m.; on a conifer; 1 Jan. 1947, *Ludlow, Sherriff & Elliot 12056*.

Distribution: this species, common in the northern hemisphere, has previously been recorded abundantly in Sikkim.

Bondarzewia montana (Quél.) Singer in Ann. Myc. xxxix: 47 (1941).

Cerioporus montanus Quél. in Ass. Franc. xvi, 2: 589, t. 21, fig. 10 (1888).
Polyporus montanus (Quél.) Ferry in Rev. Myc. xix: 144 (1897).
Grifola montana (Quél.) Pilát, Atl. Champign. Eur., iii: 55 (1936).

NEPAL: Dhotbas, south of Chakure Lekh, 2,800 m.; on a dead trunk in *Tsuga*-forest; 12 Oct. 1952, *Polunin, Sykes & Williams 5559*.

'Fawn-coloured above, cream beneath': spores 6–7 × 5–6 μ (spore-body), densely echinulate with more or less flattened spines 1–1·5 μ long, often in transverse rows, amyloid.

Distribution: Europe, Nepal and N. America.

The single specimen of this collection was not well preserved, but the characteristic spores were very abundant. I have preferred Singer's genus for the species because, as mentioned under *Amylaria himalayensis* (Clavariaceae), the alliance of *Bondarzewia* seems to be different from that of other polypores. (E. J. H. C.)

Fomes marginatus (Fr.) Gillet, Champign. Franc.: 683 (1878).

Polyporus marginatus Fr., Syst. Myc. i: 372 (1821).

S.E. TIBET: Pome, Tongkyuk Dzong, 2,850 m.; on a dead conifer; 1 Jan. 1947, *Ludlow, Sherriff & Elliot 12057*.

NEPAL: Between Panlotbas and Ranga Chauthaka, south of Chakure Lekh, 285 m.; on dead tree-trunk; 11 Oct. 1952, *Polunin, Sykes & Williams 5546*.

Distribution: widespread in the northern hemisphere; it has also been recorded from India, Japan and Mexico.

Fomes roseus (Fr.) Cooke in Grevillea xiv: 21 (1885).

Polyporus roseus Fr., Syst. Myc. i: 372 (1821).

NEPAL: Munigaon, south-east of Jumla, 2,850 m.; on fallen tree-trunk; 28 Sept. 1952, *Polunin, Sykes & Williams 5450*.

Distribution: N. America, Europe, Asia Minor, India and Nepal.

Ganoderma lucidum (Fr.) Karst., in Rev. Myc. xxxix: 17 (1881).

Polyporus lucidus Fr., Syst. Myc. i: 353 (1821).

S.E. TIBET: Pome, Gyadzong, Yigrong Chu, 2,270 m.; in mixed forest; 20 Jan. 1947, *Ludlow, Sherriff & Elliot 12162*.

Distribution: cosmopolitan. Widely recorded from India.

Grifola sulphurea (Fr.) Pilát in Beih. Bot. Centralb. lii: 39 (1934).

Polyporus sulphureus Fr., Syst. Myc. i: 357 (1821).

S.E. TIBET: Pome, Gyadzong, Yigrong Chu, 2,590 m.; on pine trees; *Ludlow,* *Sherriff & Elliot 12172*. Same locality; on *Tsuga dumosa* (D. Don) Eichl.; 22 Jan. 1947, *Ludlow, Sherriff & Elliot 12174*.

NEPAL: Dhotbas, south of Chakure Lekh, 2,550 m.; on dead tree-trunk; 12 Oct. 1952, *Polunin, Sykes & Williams 5560*.

Distribution: cosmopolitan.

Inonotus radiatus (Fr.) Karst., in Rev. Myc. iii: 19 (1881).

Polyporus radiatus Fr., Syst. Myc. i: 369 (1821).

NEPAL: Between Panlotbas and Ranga Chauthaka, south of Chakure Lekh, 2,550 m.; on moss-covered trunk; 11 Oct. 1952, *Polunin, Sykes & Williams 5537*.

Distribution: cosmopolitan.

Leptoporus borealis (Fr.) Pilát, Atl. Champign. Eur. iii: 234 (1936).

Polyporus borealis Fr., Syst. Myc. i: 366 (1821).

NEPAL: Between Panlotbas and Ranga Chauthaka, south of Chakure Lekh, 2,850 m.; on roots of trees; 11 Oct. 1952, *Polunin, Sykes & Williams 5545*.

Distribution: cosmopolitan.

Phellinus igniarius (Fr.) Quél., Ench.: 172 (1886).

Polyporus igniarius Fr., Syst. Myc. i: 375 (1821).

S.E. TIBET: Takpo, Kongbo Nga La, Tsangpo valley, 4,090 m.; on wood of *Betula utilis* Don; 13 May 1938, *Ludlow, Sherriff & Taylor 4249a*.

The spores are spherical, hyaline, 6 μ diam.

Distribution: previously recorded from Europe, Asia Minor, Eritrea and Madagascar.

Phellinus pini (Fr.) Pilát, Atl. Champign. Eur. iii: 516 (1936).

Daedalea pini Fr., Syst. Myc. i: 336 (1821).

NEPAL: Munigaon, south-east of Jumla, 2,850 m.; on fallen tree-trunk; 28 Sept. 1952, *Polunin, Sykes & Williams 5449*.

Distribution: America, Europe, India and Nepal.

Polyporellus brumalis (Fr.) Karst., in Medd. Soc. Faun. Fl. Fenn. v: 37 (1879).

Polyporus brumalis Fr., Syst. Myc. i: 348 (1821).

NEPAL: Between Samela and Dhaulakot, 2,550 m.; on fallen branch in forest; 5 May 1952, *Polunin, Sykes & Williams 3845*.

Distribution: cosmopolitan.

Polyporellus arcularius (Fr.) Pilát, Atl. Champign. Eur. iii: 75 (1936).

Polyporus arcularius Fr., Syst. Myc. i: 342 (1821).

NEPAL: Between Panlotbas and Ranga Chauthaka, south of Chakure Lekh, 2,850 m.; growing beneath roots of tree; 11 Oct. 1952, *Polunin, Sykes & Williams 5542*.

Distribution: cosmopolitan.

The specimens are ochraceous with brown stems, the pores appear to be elongate-angular but owing to extreme flattening in the press their normal form is uncertain.

Polystictus affinis (Bl. & Nees) Fr. in Nov. Act. Reg. Soc. Sci. Upsal. Ser. 3, i: 75 (1851).

Polyporus affinis Bl. & Nees in Nov. Act. Phys.-med. Acad. Caes. Leop.-Carol. Nat. Cur. xiii: 18, t. 4 (1826).

NEPAL: Samela, 2,100 m.; on fallen tree-trunk; 15 Oct. 1952, *Polunin, Sykes & Williams 5689.*

Distribution: recorded from India, Sumatra, Java, Australia, the Phillipines and Brazil.

Polystictus cinnamomeus (Pers.) Sacc., Syll. vi: 210 (1888).

Polyporus cinnamomeus Pers., Myc. Eur. ii: 41 (1825).
P. perennis forma *cinnamomeus* (Pers.) Pilát, Atl. Champign. Eur. iii: 582 (1936).

NEPAL: Between Rohagoan and Lulo Khola, Suli Gad, 3,000 m.; in leaf mould of mixed forest; 15 Sept. 1952, *Polunin, Sykes & Williams 3410.*

Spores yellow, globose to subglobose $5–7 \times 6–8\,\mu$.

Distribution: America, Europe, India and Nepal.

Polystictus velutinus (Fr.) Cooke in Grevillea xiv: 83 (1886).

Polyporus velutinus Fr., Syst. Myc. i: 368 (1821).

S.E. TIBET: Pome, Gyadzong, Yigrong Chu, 2,420 m.; on dead wood in pine forest; 29 Jan. 1947, *Ludlow, Sherriff & Elliot 12190.*

Distribution: cosmopolitan and frequently recorded from India.

Cooke's name has been retained for these coriaceous, thin, velvety specimens to distinguish them from the thicker, softer *Trametes pubescens* (Fr.) Pilát. Pilát includes both forms under the latter name.

Trametes abietina (Fr.) Pilát, Atl. Champign. Eur. iii: 273 (1936).

Polyporus abietinus Fr., Syst. Myc. i: 370 (1821).

NEPAL: Between Samela and Dhaulakot, 2,550 m.; on trunk of dead *Tsuga* sp.; 5 Apr. 1952, *Polunin, Sykes & Williams 3849.*

S.E. TIBET: Takpo, Lenda, Tsangpo valley, 3,480 m.; on *Larix mastersiana* Rehd. & Wils.; 21 May 1938, *Ludlow, Sherriff & Taylor 4379.*

Distribution: common in the temperate zone of the northern hemisphere as well as in the Himalayas.

Fine large specimens. Hymenium varying from cinnamon to fuscous. Microscopical details are identical with those of European representatives.

Trametes pubescens (Fr.) Pilát, Atl. Champign. Eur. iii: 263 (1936).

Polyporus pubescens Fr., Syst. Myc. i: 367 (1821).

NEPAL: Suli Gad, below Lulo Khola, 3,600 m.; on trunk of dead tree; 16 Sept. 1952, *Polunin, Sykes & Williams 3457*.

Distribution: also known from N. America, Europe, Asia Minor.

A variable species (*vide* note under *Polystictus velutinus*).

Trametes heteromorpha (Fr.) Bres. apud Neuman in Wisc. Geol. & Nat. Hist. Surv. Bull. xxxiii: 40 (1914).

Daedalea heteromorpha Fr., Syst. Myc. i: 340 (1821).

NEPAL: Gad Rangchi, 1,650 m.; on dead tree-trunk; 16 Oct. 1952, *Polunin, Sykes & Williams 5756*.

Distribution: cosmopolitan.

Trametes versicolor (Fr.) Pilát, Atl. Champign. Eur. iii: 261 (1936).

Polyporus versicolor Fr., Syst. Myc. i: 368 (1821).

S.E. TIBET: Pome, Gyadzong, Yigrong Chu, 2,590 m.; on dead wood in pine forest; 23 Jan. 1947, *Ludlow, Sherriff & Elliot 12177*.

NEPAL: near Hurikot, 3,000 m.; on dead tree stump; 25 Sept. 1952, *Polunin, Sykes & Williams 5408*.

Distribution: cosmopolitan. Frequently recorded from the Himalayas and Peninsular India.

Stereum hirsutum Fr., Epicr. Syst. myc.: 549 (1838).

S.E. TIBET: Takpo, Lenda, Tsangpo valley, 3,300 m.; on wood; 8 May 1938, *Ludlow, Sherriff & Taylor 4176*.

Distribution: this cosmopolitan species has previously been recorded from the Himalayas and elsewhere in India.

Stereum lobatum Fr. Epicr. Syst. Myc.: 547 (1838).

BHUTAN: Takila, 1,800 m.; on rotting tree-trunk; 1 Oct. 1949, *Ludlow, Sherriff & Hicks 21277*.

Distribution: frequently recorded from the southern hemisphere including India.

Stereum purpureum Fr., Hymenomyc. Eur.: 639 (1874).

S.E. TIBET: Pome, Gyadzong, Yigrong Chu, 2,400 m.; in forest of *Quercus*, *Ilex* and pine; 26 Jan. 1947, *Ludlow, Sherriff & Elliot 12184*.

Distribution: this world-wide species has been recorded from Darjeeling and elsewhere in India.

Hymenochaete mougeotii (Fr.) Cooke in Grevillea viii: 147 (1880).

Thelephora mougeotii Fr., Elench. Fung.: 188 (1828).

S.E. TIBET: Pome, Tongkyuk Dzong, 2,850 m.; fairly common on trees and boulders; 6 Jan. 1947, *Ludlow, Sherriff & Elliot 12068.*

Distribution: this world-wide species has previously been recorded from E. Nepal and Sikkim.

Tremella frondosa Fr., Syst. Myc. ii: 212 (1822).

S.E. TIBET: Pome, Yigrong Tso, 2,400 m.; on tree-trunk in pine forest; 12 Feb. 1947, *Ludlow, Sherriff & Elliot 12202.*

Distribution: N. & S. America, Europe, China and Tasmania.

Tremella mesenterica Fr., Syst. Myc. ii: 214 (1822).

S.E. TIBET: Kongbo, above Sang, Tsangpo valley, 3,150 m.; 25 June 1938, *Ludlow, Sherriff & Taylor 4988.*

Distribution: cosmopolitan.

Hirneola tenuis (Lév.) Sacc., Syll. vi: 769 (1888).

Exidia tenuis Lév. in Ann. Sci. Nat. Sér. 3, Bot. ii: 219 (1844).

S.E. TIBET: Pome, Sangyu, Yigrong Chu, 2,100 m.; on old wood in wet forest, edible; 14 Jan. 1947, *Ludlow, Sherriff & Elliot 12149.*

Distribution: East Indies and Tibet.

Exobasidium pieridis P. Henn. in Engl. Bot. Jahrb. xxx: 38 (1902).

NEPAL: Tilyapato between Bartha Lagna and Karnali, 1,710 m.; on leaves of *Lyonia* (*Pieris*) *ovalifolia*; 23 Apr. 1952, *Polunin, Sykes & Williams 1939.*

Distribution: previously known from N. India and was originally described from Japan on the same host. *E. fawcettii* Massee (in Bull. Misc. Inf. Kew, 1908: 217 (1908)) on leaves of *Lyonia jamaicensis*, in Jamaica is probably a synonym.

Amylaria Corner, gen. nov.

Receptacula clavarioidea erecta applanato-ramosa subcoriacea, ad terram vel ad lignum putridum: sporis albis, amyloideis, late ellipsoideis, tunica paullum incrassata, uniguttatis: cystidiis nullis: hyphis subdimiticis, aliis fibulato-septatis et vix inflatis, tenue tunicatis, ramosis, aliis crasse tunicatis, haud septatis, sparsim ramosis, longitudinalibus vel intertextis, sed multis ut cellulis modo elongatis intercalaribus hypharum alterarum: species unica, *A. himalayensis.*

A. himalayensis Corner, sp. nov. (Fig. 1.)

Ad 10 cm. alta, caespitosa laxe pluries (3–6) ramosa, alba vel subcervina, sicca ochraceo-alutacea apices versus brunnescens, ex integro in plano unico divisa, inferne multifida axillis flabellatis 5–13 mm. latis, superne bifida, ramulis obtusis dein attenuatis, filiformibus vel ligulatis, 1 mm. latis: stipite ad 30 × 3–5 mm.: hymenio

amphigeno vel ad ramos obliquos inferiori: interdum e parte resupinato, –6 cm. lato, 1 mm. crasso, fertili evoluta. Sporae 5–6·5×4·5–5·2 μ, hyalinae, subglobosae vel late ellipsoideae, dense et tenuiter echinulatae vel cristatae spinulis et cristis 0·5–1 μ altis, apiculo 1 μ longo, amyloideae tunica brunnea spinulis et cristis atrocyaneis. Basidia 35–50×7–8 μ, clavata vel subventricosa, projicientia, ad basin 2–3 μ lata: sterigmata (2–) 4, 5–7 μ longa. Hymenium ad 200 μ incrassatum, subhymenio laxe intertexto. Hyphae fibulato-septatae 2–8 (–10) μ latae, saepe subfasciculatae: hyphae alterae 2–4 (–5) μ latae, tunicis ad 1 μ crassis, vel ut cellulae intercalares hypharum fibulato-septatarum ad 7 μ latae et crasse tunicatae, angustiorae in hymenium pervadentes.

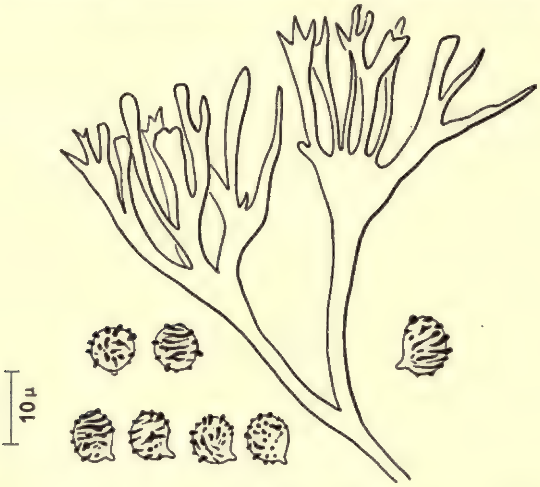

FIG. 1. *Amylaria himalayensis* Corner.
Showing a branch of a fruit-body (nat. size) and spores from *Ludlow & Sherriff 974*.

Ad terram inter muscos in silva montana vel ad lignum putridum in excavatione ad basim trunci arboris.

NEPAL: Dhotbas, south of Chakure Lekh, 2,800 m.; 12 Oct. 1952, *Polunin, Sykes & Williams 5561*.

BHUTAN: Rocha Chu valley, Trashiyangsi, 3,000 m.; 21 Sept. 1934, *Ludlow & Sherriff 974*. (Herb. Brit. Mus., holotype).

This fungus is the proof of a new clavarioid series which I have suspected for some time. Its affinity is with *Hericium* of the *Hydnaceae*. The two genera have in common the amyloid spore of very uniform size and shape: no other clavarioid genera have amyloid spores. It may seem trifling, but this is the clue which connects the erect, flabellately branched fruit-bodies of *Amylaria* with the horizontal and decurved ones of *Hericium*. The spines of *Hericium* are, in fact, the positively geotropic branchlets of a clavarioid fruit-body, and *Hericium* stands to *Amylaria* as *Deflexula* to *Pterula*.

Fruit-bodies of *A. himalayensis* resemble forms of *Scytinopogon angulisporus* (Pat.) Corner, with flabellate branching. The hyphae, however, are imperfectly dimitic, as in *Pterula*. The larger, thick-walled hyphae resemble skeletal hyphae, but they are

merely the very elongate segments of the clamped, or generative, hyphae. But, from these generative hyphae, which at first compose the mass of the tissue, there grow out many narrow, thick-walled hyphae weaving between the others and extending into the thickening hymenium in the manner of more or less unbranched binding hyphae. Thus, the tissue becomes felted and subcoriaceous, unlike that of the pteruloid genera in which the thick-walled hyphae are strictly longitudinal. The Nepal collection reveals that the fruit-bodies may arise from a resupinate, but fertile, *Corticium*-like patch, which has the same dimitic construction.

The spores resemble those of *Polyporus berkeleyi* Fr. and *P. montanus* (Quél.) R. Ferry, which are placed by Singer in his genus *Bondarzewia*. The echinulate character may be generic in *Amylaria*. The spores of *Hericium* are mostly smooth, but slight indications of asperities occur in some species. The gloeocystidia of *Hericium* are lacking from *Amylaria*, as they are from *Bondarzewia*. This genus has, also, the dimitic construction of *Amylaria*, which *Hericium* lacks. These three genera, clavaroid, hydnoid and polyporoid, show remarkable resemblance and suggest that in the Himalayan region, which I have long regarded as the most critical in the world for systematic mycology, connexions will be found with *Lactarius*, *Russula* and the asterosporous Gasteromycetes. (E. J. H. C.)

Clavariadelphus mirus (Pat.) Corner, Monogr. Clavaria: 279 (1950).

Clavaria mira Pat. in Bull. Soc. Myc. Franc. xxiii: 71 (1907).

NEPAL: Deoli Patan, south-east of Jumla, 3,800 m.; in oak-bamboo-conifer forest; 4 Sept. 1952, *Polunin, Sykes & Williams 3144*.

Up to 20 cm. × 6–12 mm., erect, cylindric to subclavate or cigar-shaped, apparently solitary but gregarious, the apex slightly tapered, rounded obtuse, hymenium subrugulose, 'light brown or fawn': stem –7 cm. long, immersed in the humus: spores 10–13 (–14) × 6·5–8·5 μ, as in *C. pistillaris* (Fr.) Donk, apiculus 1–1·5 μ: basidia 100–120 × 10–12 μ, with long flexuous base, sterigmata 2–4, 8–11 μ long: hymenium thickening, cystidia none: hyphae –15 μ wide, clamped, thin-walled, long-celled, containing much oil.

Distribution: the only collection of this species, hitherto, is from Indo-China.

Patouillard described the spores as 8–10 × 4–5 μ, which are smaller than in the Nepal collection, but they may have been immature: there is also a clear error in his description of the basidia. The species is near *C. pistillaris* but is much narrower, relatively taller, and brown. Thus, it recalls large specimens of *C. fistulosus*, but the fruit-bodies of *C. mirus* have the solid construction of *Eu-clavariadelphus* (E. J. H. C.)

Clavariadelphus sachalinensis (Imai) Corner, Monogr. Clavaria: 282 (1950).

Clavaria sachalinensis Imai in Trans. Sapporo Nat. Hist. Soc. xi: 73 (1930).

Up to 8 cm. high, elongate clavate, drying brownish ochraceous: spores 16–20 × 5–5·5 μ, cylindric, thin-walled, colourless, aguttate: basidia *c.* 100 × 10 μ: hyphae up to 10 μ wide clamped, thin-walled.

S.E. TIBET: Tsanang La, near Paka, 3,200 m.; in moss under *Abies*-forest; 20 July 1938, *Ludlow, Sherriff & Taylor 5881*.

Distribution: this is the first authentic record of the species outside Japan, though it probably occurs in North America.

The larger spores and basidia, as well as the more intense colour of the fruit-body, distinguish the species from its close ally *C. ligula* (Fr.) Donk. (E. J. H. C.)

Ramaria fuscobrunnea Corner, sp. nov.

Ramaria flaccidae et *R. invalii* valde affinis, sed receptaculis majoribus, sordide brunneis.

Ad 11 cm. alta, caespitosa, multum ramosa, stipite vix evoluto, brunnea, dein fuscescentia, sicca griseo-brunnea vel fusca: ramis inferne 5–8 mm. latis et polychotomis, superne gradatim angustioribus, apicibus 1 mm. latis, internodis plus minus elongatis–15 mm. longis. Sporae 6·5–10 × 3·5–4 μ, raro 11 × 5 μ vel 12 × 3·5 μ, brunneo-ochraceae, anguste pyriformes vel subcylindricae, tenue echinulatae spinulis hyalinis 0·5–1 μ longis. Hyphae ad 12 μ latae, fibulatae, tenue tunicatae, plerumque ad septa hypharum longitudinalium ampullata.

NEPAL: Tarakot, 3,400 m.; under *Picea*; July 1952, *Polunin, Sykes & Williams 2635*.

S.E. TIBET: Valley above Sang, 3,200 m.; on humus under *Quercus-Ilex* forest; 26 June 1938, *Ludlow, Sherriff & Taylor 4988b*. (Herb. Brit. Mus., holotype). (E. J. H. C.)

Ramaria subaurantiaca Corner, sp. nov.

Ramaria flavae affinis, sporis brevioribus, colore subaurantiaco. An *R. rufescens* sensu Bresadola?

Ad 10 cm. alta, multum ramosa, crocea ('saffron'), sicca sordide brunneo-ochracea: stipite ad 5 cm. × 8–12 mm., distincto, sicco rufescenti: ramis crassis polychotomis, ramulis obtusis dichotomis congestis. Sporae 9–11·5 × 4·7–6 μ, ochraceae, ellipsoideae, ruguloso-subverrucosae, obtusae, uniguttatae. Hyphae ad 16 μ latae, haud fibulatae, tunicis tandem paullum incrassatis: hymenio haud incrassato.

S.E. TIBET: Kongbo, Shoga Dzong, 3,200 m.; on earth under *Berberis*; 22 July 1947, *Ludlow & Sherriff 14183*. Kongbo, Deyang La, 3,150 m.; on rotting branches; 7 Aug. 1947, *Ludlow & Sherriff 1421*. (Herb. Brit. Mus., holotype). (E. J. H. C.)

Ramariopsis kunzei (Fr.) Donk var. **deformis** Corner, Monogr. Clavaria: 641 (1950).

Spores 5–5·5 × 4·5–5 μ, white, subglobose, echinulate with spines 0·5 μ long: hymenium-thickening strong, containing thick-walled abortive basidia with 0–4 sterigmata, their walls up to 3 μ thick: hyphae up to 12 μ wide, clamped.

S.E. TIBET: Kongbo, Pangkar, 4,000 m.; in dry grass; 7 Sept. 1947, *Ludlow & Sherriff 15691*.

The field-note 'light brown' refers, probably, to the dried-up fruit bodies.

Distribution: Europe apart from the present record. (E. J. H. C.)

Calocera viscosa Fr., Syst. Myc. i: 486 (1821).

E. Bhutan: Rocha Chu valley, Trashiyangsi, 3,200 m.; 'bright deep orange yellow', up to 12 cm. high; 21 Sept. 1934, *Ludlow & Sherriff 973*.

S.E. Tibet: Kongbo, Deyang La, 3,200 m.; on decaying wood, 'very rich orange', up to 7 cm. high; 7 Aug. 1947, *Ludlow, Sherriff & Elliot 14242*.

Spores (in both collections) $7{\cdot}5$–10×4–$5\,\mu$, hyaline, aseptate.

Distribution: America, W. Indies, Europe and Asia including India and the present records. (E. J. H. C.)

GASTEROMYCETES

Astraeus hygrometricus (Pers.) Morg. in Journ. Cincinnati Soc. Nat. Hist. xii: 20 (1889).

Geastrum hygrometricum Pers., Synops. Meth. Fung. i: 135 (1801).

Nepal: Chaudhabise Khola, 3,000 m.; in dryish soil under *Pinus*; 20 May 1952, *Polunin, Sykes & Williams 983*.

Distribution: previously known from N. America, Europe, India and Australia.

Geastrum triplex Jungh. in Tijdschr. Nat. Ges. Physiol. vii: 287, t. 8, figs. 1–3 (1840).

Nepal: Lulo Khola, 3,900 m.; in leaf soil of coniferous forest; 16 Sept. 1952, *Polunin, Sykes & Williams 3447*.

Distribution: cosmopolitan.

Disciseda cervina (Berk.) Hollós in Növényt. Közlem. i: 107 (1902).

Bovista cervina Berk. in Ann. & Mag. Nat. Hist. ix: 447 (1842).

Nepal: Durpa, north of Margor Lagna, 2,700 m.; on bare patches of loose, dry, gritty soil between clumps of thyme and bracken; 26 May 1952, *Polunin, Sykes & Williams 4179*.

Distribution: North America, Europe, India, Australia and New Zealand.

The spores are 5–6 μ diam. and coarsely warted. *D. verrucosa* G. H. Cunningham described from Australia, as well as certain other species, will doubtless prove synonymous when the genus can be critically examined.

Lycoperdon atropurpureum Vitt., Monogr. Lycoperd.: 42 (1842).

Nepal: Maharigaon, 4,500 m.; on peaty grass slopes; 20 July 1952, *Polunin, Sykes & Williams 225*.

Distribution: America, Europe and Nepal.

Dark purplish brown turbinate specimens, surface granules probably worn away. Spores purplish brown, $4{\cdot}5$–$6{\cdot}5\,\mu$ including $1\,\mu$ long spines. Capillitium brown.

Lycoperdon caelatum Fr., Syst. Myc. iii: 32 (1829).

NEPAL: Dozam Khola, below Kharchyun, near Simikot, 3,750 m.; on surface of slopes of grass and *Rumex*; 1 June 1952, *Polunin, Sykes & Williams 4284.*

Distribution: America, Europe, Africa, India, Australia.

Lycoperdon perlatum Pers., Synops. Meth. Fung. i: 149 (1801).

S.E. TIBET: Pome, Tongkyuk Dzong, 2,850 m.; in moss among rhododendron and pine; 1 Jan. 1947, *Ludlow, Sherriff & Elliot 12055.*

Distribution: cosmopolitan.

Lycoperdon pyriforme Pers., Synops. Meth. Fung. i: 148 (1801).

NEPAL: Suli Gad, below Lulo Khola, 3,600 m.; on soil and dead wood in mixed forest; 16 Sept. 1952, *Polunin, Sykes & Williams 3455.*

Distribution: cosmopolitan.

Mitremyces junghuhnii Schlecht. & Müll. in Bot. Zeit. 1844: 401, t. 3B (1844).

S.E. TIBET: Monyul, Gyipu, Nyam Jang Chu, 2,500 m.; on damp soil in dense forest; 24 March 1936, *Ludlow & Sherriff 1229.*

Distribution: Sikkim, Bhutan, S.E. Tibet and East Indies.

Crucibulum vulgare Tul. in Ann. Sci. Nat. Sér. 3. Bot. i: 90 (1844).

S.E. TIBET: Kongbo, Molo, 3,300 m.; on old wood; 21 May 1938, *Ludlow, Sherriff & Taylor 4380.*

Distribution: cosmopolitan. In India previously recorded from the Nilgiris.

Cyathus lesueurii Tul., in Ann. Sci. Nat. Sér. 3, Bot. i: 79 (1844).

NEPAL: Jumla, 3,000 m.; in earth banks under pine; 8 Aug. 1952, *Polunin, Sykes & Williams* 394. Jumla, 2,280 m.; on bare stoney patch of soil, when unripe resembling the smaller stones; 4 July 1952, *Polunin, Sykes & Williams 4436.*

Distribution: known from America and Australia.

The present representatives of this species are quite typical: smooth, discoid, blackish sporangioles; large spores 25–35 × 20–25 μ.

UREDINALES

Aecidium circaeae Ces. & Mont. in Syll. Crypt.: 312 (1856).

NEPAL: Chutta, south-east of Jumla, 3,300 m.; on *Circaea alpina* L.; 25 July 1952, *Polunin, Sykes & Williams 4976.*

Distribution: previously known from Europe, Siberia, Japan.

Aecidium cunninghamianum Barclay in Journ. As. Soc. Bengal lx, 2: 224 (1891).

NEPAL: Chaurkot, south-east of Jumla, 3,000 m.; on leaves of *Cotoneaster* sp.; 27 Sept. 1952, *Polunin, Sykes & Williams 5431.*

Distribution: previously only known from Punjab (Simla).

Arthur and Cummins (1933) record *Gymnosporangium cunninghamianum* Barclay on *Cotoneaster bacillaris* from Landour, Mussoorie. Barclay thought that his *Aecidium cunninghamianum* might be a stage of this *Gymnosporangium* but Sydow (Mono. Uredin. iv: 224 (1924)) considers this unlikely. The Nepal collections on *Pyrus* (*vide Gymnosporangium cunninghamianum*) and *Cotoneaster* respectively, support Sydow's view that the two are quite distinct. The peridial cells and aecidiospores on *Pyrus* (= *Gymnosporangium cunninghamianum*) are considerably larger than those on *Cotoneaster* (*Aecidium cunninghamianum*).

Aecidium infrequens Barclay in Journ. As. Soc. Bengal lix, 2: 105 (1890).

NEPAL: Thakurji Lekh, south of Jumla, 3,450 m.; on leaves of *Geranium* sp.; 18 July 1952, *Polunin, Sykes & Williams 4765*.

Distribution: previous records from Punjab and Kashmir.

Aecidium montanum Butler in Indian Forester xxxi: 676 (1905).

NEPAL: Dozam, near Simikot, 2,550 m.; on leaves of *Berberis chitria* Lindl.; 28 May 1952, *Polunin, Sykes & Williams 2644*.

Distribution: several previous collections on *Berberis* spp. in the Himalayas (Mussoorie, Jaunsar, Kashmir).

Aecidium pleurospermae Balfour-Browne, sp. nov.

Pycnidiis epiphyllis: aecidiis hypophyllis, vel petiolicolis, maculis aurantiis insidentibus, in greges rotundatos 3–5 mm. diam., vel ad petiolos elongatos dispositis, cupulatis, margine inciso: aecidiosporis globoso-angulatis vel ellipsoideis, subtiliter verruculosis, subhyalinis $18–25 \times 14–20\,\mu$.

NEPAL: Chakure Lekh, 3,600 m.; on leaves of *Pleurospermum* sp.; 17 July 1952, *Polunin, Sykes & Williams 4742*. (Herb. Mus. Brit., holotype).

Differs only in the colour of the spots and in the host from the *Aecidium saniculae* described by Barclay (Journ. As. Soc. Bengal, lvi, 2: 352 (1888)) on *Sanicula*. P. & H. Sydow (Monogr. Uredin. i: 414 (1904)) suggested that Barclay's *Aecidium* might belong to *Puccinia saniculae* Grev.

Aecidium rhododendri Barclay in Sci. Mem. Med. Off. Army Ind. vi: 71–74 (1891).

Aecidium sino-rhododendri M. Wils. in Not. R. Bot. Gard. Edinb. xii: 261 (1921).

NEPAL: Thakurji Lekh, south of Jumla, 3,450 m.; on leaves of *Rhododendron campanulatum* D. Don; 18 July 1952, *Polunin, Sykes & Williams 4767*. Maharigaon (5 miles north-east), 4,200 m.; on leaves of *Rhododendron campanulatum*; 22 July 1952, *Polunin, Sykes & Williams 280*.

Distribution: this Nepal fungus is identical with the *Aecidium* described by Barclay on the same species of *Rhododendron* from Simla and referred to by name in his diagram on p. 74. Wilson's *Aecidium sino-rhododendri* on *R. calvescentes* Balf. f. & Forrest from S.E. Tibet is an undoubted synonym.

Aecidium urceolatum Cooke in Grevillea vii: 61 (1878).

NEPAL: Bhurchula Lekh, near Jumla, 4,200 m.; on *Thalictrum* sp.; 13 July 1952, *Polunin, Sykes & Williams 4621.*

S.E. TIBET: Kongbo, Sang, Tsangpo valley, 2,850 m.; on *Thalictrum minus* L.; 26 June 1938, *Ludlow, Sherriff & Taylor 4991.*

Distribution: previously recorded from Kanawar and Punjab.

Sydow (Monogr. Uredin. i: 826 (1904)) considers this close to the aecidial stage of *Puccinia persistens* Plowr.

Chrysomyxa himalense Barclay in Sci. Mem. Med. Off. Army Ind. v: 83, tt. 1, 2 (1890).

NEPAL: Between Chankheli Lagna and Darma, 3,300 m.; on petioles of *Rhododendron* sp.; 20 May 1952, *Polunin, Sykes & Williams 4140.*

S.E. TIBET: Kongbo, Molo, 3,150 m.; on leaves of *Rhododendron vellereum* Hutch.; 19 May 1938, *Ludlow, Sherriff & Taylor 4324.*

Distribution: India and S.E. Tibet.

In the specimen cited, the fungus is confined to the under surface of the leaves, whereas, previously, it has been recorded as occurring on or near the petioles and veins. The Tibetan specimens also differ from the type in having teleutosori with long stalks up to 2 mm. in length which give the fungus the appearance of a golden yellow *Stilbum.* The elongated stalks may be an adaptation to raise the spores above the thick tomentation of the leaves of this species of *Rhododendron.*

Chrysomyxa taghishae Balfour-Browne, sp. nov. (taghisha = Nepalese for Rhododendron).

Soris teleutosporis hypophyllis non in ramalis, 0·4–0·7 mm. diam., dense confertis, confluentibus subinde majoribus, rotundatis vel elongatis, pulvinatis, aureis vel aureobrunneolis: teleutosporis in catenas 80–120 μ longas oriundis, oblongis 8–12 $\times$ 20–24 μ: promycelis curvatis circ. 20 $\times$ 8 μ: sporidiis aureis, rotundatis 8–12 μ.

NEPAL: near Babaria Lekh (Tibrikot–Jumla), 3,300 m.; on leaves of dwarf *Rhododendron*; 29 July 1952, *Polunin, Sykes & Williams 2121.* (Herb. Brit. Mus., holotype).

Differs from *C. himalense* Barclay in having the sori quite sessile, frequently confluent and occurring on the lower epidermis of the leaves and apparently not at all on the petioles, fruits or branches.

The fungus distributed by Jaczewski, Komarov & Tranzschel (*Fungi Rossiae exs. No. 324*) under the name *C. rhododendri* De Bary. is undoubtedly identical with the Nepal species; its teleutosori differ from those of authentic *C. rhododendri* in being more abundant, thicker and often confluent. Microscopically there is no noteworthy difference in size of teleutospore chains, teleutospores or sporidia in either *C. himalense* or *C. taghishae,* or yet in *C. dietelii* described by Sydow from Kumaon. This last has very sparse, small sori, 0·1–0·2 mm. diam. (Sydow in Ann. Myc. v: 502 (1907)).

The teleutosori of *Chrysomyxa* spp. on Asiatic *Rhododendron* spp. form a series showing a gradual difference in size from the small, sessile *C. dietelii,* through the somewhat larger, still sessile, *C. taghishae* and the shortly-stalked forms of *C. himalense*, from Simla and Nepal, to the large, long-stalked Tibetan forms of this latter species. Experimental work can only decide whether these forms do, in fact, represent distinct species or merely growth responses to different species of host plant.

Coleosporium campanulae (Pers.) Winter in Rabenh., Krypt.-Fl. i, 1: 246 (1881).

Uredo campanulae Pers., Synops. Meth. Fung. i: 217 (1801).

NEPAL: Sarda Khola, 105 m.; on leaves of *Campanula colorata* Wall.; 28 March 1952, *Polunin, Sykes & Williams 3708.*

Distribution: America. Europe, Japan and very commonly recorded in India.

cf. **Gymnosporangium clavariaeforme** DC., Flor. Franc. ii: 217 (1805).

NEPAL: Pudamigaon, Dojam, Khola, 3,600 m.; on fruits of *Cotoneaster* sp.; 22 Sept. 1952, *Polunin, Sykes & Williams 3546.*

Distribution: N. America, Europe, Algeria. This species has not previously been recorded from Asia, nevertheless the present fungus agrees very closely with it.

Gymnosporangium cunninghamianum Barclay in Sci. Mem. Med. Off. Army Ind. v: 78, tt. 1–3 (1890).

NEPAL: Mugu Karnali valley, between Daura and Mangri, 2,400 m.; on leaves of *Pyrus* sp.; 25 Aug. 1952, *Polunin, Sykes & Williams 3032.*

Distribution: this species was originally described by Barclay (Journ. As. Soc. Bengal lvi, 2: 370 (1887)) from *Pyrus variolosa* Wall. under the name '*G. clavariaeforme* Jacq.'. He realized later that it represented a distinct species. It has since been recorded from several localities in India including the Himalayas.

Gymnosporangium padmarense Balfour-Browne, sp. nov. (Fig. 2.)

Pycnidiis et aecidiis ignotis. Soris teleutosporiferis ramicolis, cylindraceis 4–8 mm. longis, 2–3 mm. latis, vel pulvinatis, castaneo-brunneis: teleutosporis lineari-fusiformibus, apice leniter attenuatis, 1–septatis, non constrictis, basi attenuatis, aurantiis, 130–200 × 15–18 μ: episporio 1 μ crasso: pedicello hyalino, cylindraceo, longissimo.

NEPAL: Padmara, 2,850 m.; on branches of *Juniperus indica* Bertol.; 13 May 1952, *Polunin, Sykes & Williams 4075.* (Herb. Brit. Mus., holotype).

Resembles *G. ellisii* (Berk.) Farl. in Ellis, N. Am. Fungi: 271 (1879), in having very elongate fusiform teleutospores. In the Nepal species, however, these are even longer and are 1-septate, never 2- or 3-septate.

Melampsora helioscopiae (Schumach.) Wint. in Pilze Deutschl.: 240 (1881).

Uredo helioscopiae Schumach., Enum. Pl. ii: 229 (1803).

NEPAL: Pina, near Rara, 2,400 m.; on leaves of *Euphorbia* sp.; 14 May 1952, *Polunin, Sykes & Williams 4085.*

Distribution: N. America, Europe, Abyssinia and India.

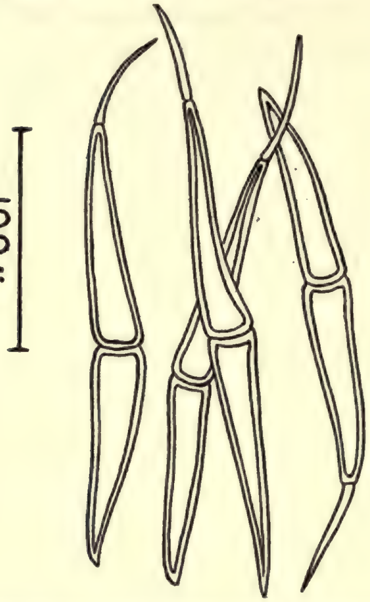

FIG. 2. *Gymnosporangium padmarense* Balfour-Browne.
Teleutospores from *Polunin, Sykes & Williams 4075*.

Melampsora magnusiana G. Wagner in Oester. Bot. Zeitschr. xlvi: 273 (1896).

[*Caeoma fumariae* Link in L., Sp. Pl., ed. 4, vi, pt. 2: 24 (1825), *stat. imperf.*]
Caeoma chelidonii P. Magn. in Hedwigia xiv: 20 (1875).

NEPAL: Bhurchula Lekh, near Jumla, 3,600 m.; on leaves of *Meconopsis* sp.; 15 July 1952, *Polunin, Sykes & Williams 4697*. Thakurji Lekh, south of Jumla, 4,200 m.; on *Corydalis* sp.; 16 July 1952, *Polunin, Sykes & Williams 4716*.

Distribution: hitherto recorded on various *Papaveraceae*, in Europe and Russia.

Melampsora sp.

NEPAL: Thakurji Lekh, south of Jumla, 3,450 m.; on leaves of *Saxifraga moorcroftiana* Wall.; 18 July 1952, *Polunin, Sykes & Williams 4764*.

Aecidia amphigenous, scattered over the whole leaf, circular, 0·5–1 mm. diam.: aecidiospores irregularly angular-globose, hyaline, densely verruculose, 17–26×14–17 μ: epispore 2–3 μ thick.

Melampsora has not previously been recorded on *Saxifraga* from the Himalayas. As only the *Caeoma* stage is represented (and this is not distinctive in the various spp. of *Melampsora* on this host from other parts of the world) identification must wait until this can be related to its teleutospore stage.

Ochropsora ariae (Fuck.) Syd., Monogr. Uredin. iii: 661 (1915).

Melampsora ariae Fuckel, Symb. Myc.: 45 (1869).
[*Aecidium leucospermum* DC. in Lam. & DC., Fl. Franç., ed. 3, ii: 239 (1805), *stat. imperf.*]

NEPAL: Jumla, 2,250 m.; on leaves of *Anemone rivularis* Buch.-Ham., growing on terrace cultivation banks; 4 May 1952, *Polunin, Sykes & Williams 904*.

This fungus appears to be identical with that found by Barclay (Journ. As. Soc. Bengal lvi, 2: 361 (1887)) on the same host in Simla and identified by him provisionally as *Aecidium leucospermum* DC. Since then *A. leucospermum* from *Anemone nemorosa* L. in Europe has been related experimentally to a teleutospore stage on species of *Pyrus, Aria, Malus* and is referred to as *Ochropsora ariae* (Fuck.) Syd. (= *Ochropsora sorbi* (Oud.) Diet.). Morphologically, the Himalayan aecidia are identical with those on *A. nemorosa* but final identification cannot be made until the life-history of the Himalayan fungus has been determined. Arthur & Cummins (in Mycologia xxv: 400 (1933)) record *Ochropsora sorbi* (Oud.) Diet. on an *Anemone* from the states of Chamba and Alwar.

Peridermium orientale Cooke in Indian Forester iii: 91 (1877).

NEPAL: Sallyana, 1,500 m.; on needles of *Pinus roxburghii* Sarg.; 29 March 1952, *Polunin, Sykes & Williams 5948*.

BHUTAN: Kinga Rapden, 1,500 m.; on needles of *Pinus roxburghii*; 3 April 1949, *Ludlow, Sherriff & Hicks 18609*.

Distribution: previously known from India.

Recent studies on the life cycle of this rust by Bagchee (1941) indicate that the form of *Coleosporium campanulae* (Pers.) Wint. occurring on *Campanula colorata* is the alternate stage.

Peridermium thomsoni (Berk.) Berk. apud Cooke in Indian Forester iii: 94 (1877).

Aecidium thomsoni Berk. in Gard. Chron. 1852: 627 (1852).

NEPAL: Simikot, 2,850 m.; on *Picea* sp.; 6 June 1952, *Polunin, Sykes & Williams 4293*. Barbung Khola, near Tachungaon, 3,450 m.; on *Picea*; 4 June 1952, *Polunin, Sykes & Williams 1067*.

Distribution: previous records are from Simla and Sikkim on *Picea smithiana* (Wall.) Boiss.

The Nepal specimens show magnificent development of the rust which has infected all the needles of large branches thus producing a striking appearance.

Puccinia sp. cf. **apii** Desm., Cat. Pl.: 25 (1823).

NEPAL: Chakure Lekh, south of Jumla, 3,600 m.; on leaves of *Selinum candollii* DC.; 17 July 1952, *Polunin, Sykes & Williams 4741*.

Distribution: Europe, India, Japan, Tasmania.

In the absence of authentic aecial material for comparison, the identification of this specimen must be regarded as tentative.

Puccinia chelonopsidis Balfour-Browne, sp. nov. (Fig. 3.)

Soris pallidis vel brunneis: teleutosoris hypophyllis, sparsis, atro-cinnamoneis,

pulverulentis, plus minusve orbicularis, 0·5–1 mm. diam.: teleutosporis immaturis hyalinis: teleutosporis maturis atro-castaneis, late ellipsoideis vel subglobosis, utrinque rotundatis, apice vel subapice leviter incrassatis, medio non vel vix constrictis, verrucosis, 35–40 × 28–32 µ: episporio flavo, 3–4 µ crasso: pedicello hyalino, brevi, saepe oblique inserto, mox deciduo: uredosporae invisae.

In foliis vivis *Chelonopsidis albiflorae* Pax. & K. Hoffm.

S.E. TIBET: Kongbo, Sumbatse, 3,150 m.; 4 Oct. 1938, *Ludlow, Sherriff & Taylor 7174a*. (Herb. Brit. Mus., holotype).

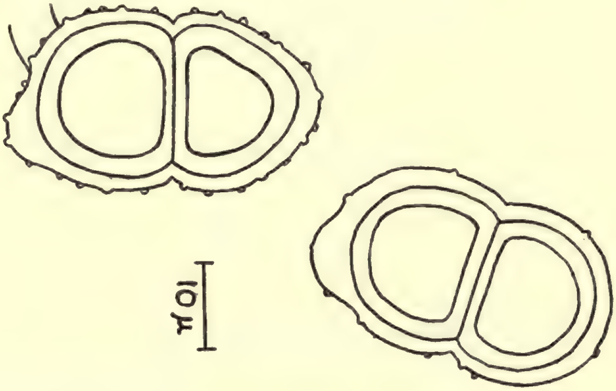

FIG. 3. *Puccinia chelonopsidis* Balfour-Browne.
Teleutospores from *Ludlow, Sherriff & Taylor 7174a*.

This rust most closely resembles some of the thick-walled, verrucose species on Salvias from the United States and Mexico but, apart from differences in geography and habitat, it is distinguished by its caducous spores with their generally thicker and more coarsely warted epispore. *P. ziziphorae* Syd. from Kurdistan and Turkestan is another species with very similar teleutosori, but the spores are smaller and the epispore thinner than in the Tibetan fungus.

Puccinia coronata Corda, Ic. Fung. i: 6 (1837).

NEPAL: Jumla, 228 m.; on leaves and petioles of *Rhamnus procumbens* Edgew.; 5 July 1952, *Polunin, Sykes & Williams 4463*.

Distribution: cosmopolitan with many records from India.

Puccinia festucae Plowr. in Gard. Chron. Ser. 3, ii: 42 (1890).

NEPAL: Bhurchula Lekh, near Jumla, 3,600 m; aecidia on leaves of *Lonicera* sp.; 15 July 1952, *Polunin, Sykes & Williams 4704*.

Distribution: previously known from N. America, Europe, north-west Himalayas and Australia.

Puccinia gentianae (Strauss) Link in L., Sp. Pl. ed. 4, vi, pt. 2: 73 (1825).

Uredo gentianae Strauss in Ann. Wetter. Ges. ii: 102 (1811).

S.E. TIBET: Kongbo, Mira La, 2,940 m.; on leaves of *Gentiana tibetica* King ex Hook. f.; 11 Aug. 1938, *Ludlow, Sherriff & Taylor 6113*.

Distribution: previously known from America, Europe, Siberia and Simla.

Puccinia graminis Pers., Synops. Meth. Fung. i: 228 (1801).

NEPAL: Shumula, below Chankheli Lagna, 3,000 m.; on leaves of *Berberis aristata* DC.; 19 May 1952, *Polunin, Sykes & Williams 4109*.

Distribution: cosmopolitan.

Puccinia heraclei Grev., Scot. Crypt. Fl. i: t. 42 (1823).

NEPAL: Chakure Lekh, south of Jumla, 3,600 m.; on leaves of *Heracleum candicans* DC.; 17 July 1952, *Polunin, Sykes & Williams 4740*.

Distribution: Europe. Has been recorded from the Himalayas by Arthur & Cummins (in Mycologia xxv: 403 (1933)).

Pycnidia and aecidia are abundant on the present specimens.

Puccinia pimpinellae (Strauss) Martius, Prodr. Fl. Mosq. ed. 2: 226 (1817).

Uredo pimpinellae Strauss in Ann. Wetter. Ges. ii: 102 (1811).

NEPAL: Thakurji Lekh, south of Jumla, 3,450 m.; on *Acronema* sp.; 18 July 1952, *Polunin, Sykes & Williams 4762*.

Distribution: America, Europe, Algeria, Asia Minor, India.

Aecidial stage only represented.

Puccinia rupestris Juel in Bot. Notis. 1893: 56 (1893).

NEPAL: Chakure Lekh, south of Jumla, 3,600 m.; on *Saussurea hieracioides*; 17 July 1952, *Polunin, Sykes & Williams 4739*.

The aecidia and spores agree exactly with those of this species previously recorded only from Norway and Sweden where the teleuto and uredospore stages are said to occur on *Carex rupestris* All.

Puccinia taylorii Balfour-Browne, sp. nov. (Fig. 4.)

Uredosoris hypophyllis, sparsis, rotundatis, pulverulentis, ochraceis: uredosporis globosis, subtiliter echinulatis, flavis vel hyalinis, 18–20 μ diam., pedicello deciduo. Teleutosoris hypophyllis, maculis pallescentibus insidentibus, sparsis vel subgregariis, saepe confluentibus, globosis, pulverulentis, atrobrunneis: teleutosporis ovatis, oblongis vel subglobosis, apice non incrassatis, medio non vel leniter constrictis, ad apicem et/vel juxta septum papillae hyalinae gerentibus, subtiliter verruculosis, castaneo-brunneis, 16–20 × 20–28 μ: pedicello hyalino, brevissimo, mox deciduo.

In foliis vivis *Polygoni polystachyi* Wall.

S.E. TIBET: Kongbo, Lusha, Tsangpo valley, 2,850 m.; 18 Sept. 1938, *Ludlow, Sherriff & Taylor 5462b*. (Herb. Brit. Mus., holotype).

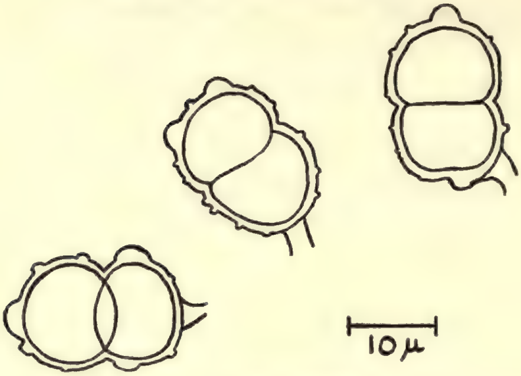

FIG. 4. *Puccinia taylorii* Balfour-Browne.
Teleutospores from *Ludlow, Sherriff & Taylor 5462b.*

Differs from *Puccinia bistortae* (Str.) DC. in its subspherical and slightly verrucose teleutospores and in bearing one or two hyaline lateral or subterminal papillae.

Puccinia violae (Schumach.) DC. in Lam. & DC. Fl. Franç. ed. 3, vi: 62 (1815).

Aecidium violae Schumach., Enum. Pl. ii: 224 (1803).

NEPAL: Thakurji Lekh, south of Jumla, 3,450 m.; on leaves of *Viola* sp.; 18 July 1952, *Polunin, Sykes & Williams 4763.* Durpa, north of Margor Lagna, 2,850 m.; on *Viola* sp.; 26 May 1952, *Polunin, Sykes & Williams 4167.*

Distribution: America, Europe, Siberia, India, Japan.

Uromyces hobsoni Vize in Grevillea iv: 115 (1876).

NEPAL: Sarda Khola, 1,200 m.; on *Jasminum* sp.; 27 Aug. 1952, *Polunin, Sykes & Williams 1222.*

Distribution: India, Somaliland, Cameroons.

USTILAGINALES

Cintractia minor (Clinton) Jackson in Mycologia xii: 153 (1920).

Cintractia axicola var. *minor* Clinton in Journ. Myc. viii: 143 (1902).

NEPAL: Marma Khola, 7,500 m.; on peduncles of *Cyperus* sp.; 18 Oct. 1952, *Polunin, Sykes & Williams 5844.*

Distribution: S. America and India.

Sphacelotheca fagopyri Syd. & Butl. in Ann. Myc. v: 486 (1907).

NEPAL: Ghurchi Lagna, Ghurchi Lekh, 3,000 m.; in flowers of *Fagopyrum* sp.; 28 Aug. 1952, *Polunin, Sykes & Williams 3064.*

Distribution: originally described from Kulu, Bengal.

Spores very finely verruculose, 11–14 μ diam.

Sphacelotheca hydropiperis (Schumach.) De Bary, Vergl. Morph. Biol. Pilze: 187 (1884).

Uredo hydropiperis Schumach., Enum. Pl. ii: 234 (1803).

NEPAL: Garjiankot, nr. Jumla, 2,550 m.; in flowers of *Polygonum* sp.; 8 Oct. 1952, *Polunin, Sykes & Williams 5511.*

Distribution: cosmopolitan.

Sphacelotheca monilifera (Ellis & Everh.) Clinton in Journ. Myc. viii: 141 (1902).

Ustilago monilifera Ellis & Everh. in Bull. Torrey Bot. Cl. xxii: 362 (1895).

NEPAL: Between Phulchangi and Chong, near Tibrikot, 2,400 m.; in ovaries of *Heteropogon contortus* (L.) Beauv.; 11 Sept. 1952, *Polunin, Sykes & Williams 3320.*

Distribution: Previous records from Hawaii, Mexico, Arizona where it has been recorded on the same grass.

Ustilago crameri Körnicke in Fuckel, Symb. Myc. ii: 11 (1873).

NEPAL: Ringmigaon, Phoksumdo Tal, 4,200 m.; in ovaries of *Setaria* sp.; 20 Sept. 1952, *Polunin, Sykes & Williams 3524.*

Distribution: America, Europe and abundantly recorded from India.

Ustilago morinae Padwick & Azmatullah in Myc. Pap. x: 1 (1944).

NEPAL: Dozam Khola, near Simikot, 3,150 m.; on inflorescence of *Morina polyphylla* Wall. ex DC.; 30 May 1952, *Polunin, Sykes & Williams 4228.*

Distribution: Hitherto only recorded on *Morina longifolia* Wall. ex DC., from Kashmir.

Ustilago olivacea (DC.) Tul. in Ann. Sci. Nat. Sér. 3, Bot. xvii: 88 (1847).

Uredo olivacea DC. in Lam. & DC., Fl. Franç. ed. 3, vi: 78 (1815).

NEPAL: Gilam, Tila valley, 1,650 m.; in ovaries of *Carex* sp. on cornfield banks; 19 Apr. 1952, *Polunin, Sykes & Williams 1914.*

Distribution: Previously known in America, Europe, and on *Carex cruciata* Wahl. from N.W. Himalayas.

ASCOMYCETES

Cyathipodia corium (Weberb.) Boud., Hist. & Class. Discomyc. Eur.: Paris 39 (1907).

Peziza corium Weberb., Pilze Nord Deutsch.: t. 3, fig. 7 (1873).

NEPAL: Dojam Khola, 4,800 m.; growing among dwarf *Salix*; 23 Sept. 1952, *Polunin, Sykes & Williams 3567.*

Distribution: America, Europe and Nepal.

Helvella crispa Fr., Syst. Myc. ii: 14 (1822).

NEPAL: Lulo Khola, 3,900 m.; in leaf soil of coniferous forest; 16 Sept. 1952, *Polunin, Sykes & Williams 3446.*

Distribution: America, Europe, India.

Leptopodia elastica (Fr.) Boud. in Bull. Soc. Myc. Franc. i: 99 (1885).

Helvella elastica Fr., Syst. Myc. ii: 21 (1822).

NEPAL: Suli Gad, below Lulo Khola, 3,900 m.; in coniferous forest; 16 Sept. 1952, *Polunin, Sykes & Williams 3454.*

Distribution: America, Europe, India and Japan.

Leptopodia pezizoides (Fr.) Boud., Ic. Myc. ii: t. 235 (1909).

Helvella pezizoides Fr., Syst. Myc. ii: 20 (1822).

S.E. TIBET: Kongbo, Mira La, 1,200 m.; growing through the undergrowth of dwarf *Salix*; 17 Aug. 1938, *Ludlow, Sherriff & Taylor 6094.*

Distribution: hitherto only known from Europe.

Sarcoscypha sherriffii Balfour-Browne, sp. nov. (Fig. 5.)

Apothecia 2–5 cm. diametro, subsessilia, cupulata demum applanata, extus luteo-brunnea et leniter tomentosa: hymenium levis, aurantioflavum: subhymenium hyphis 3 μ diametro, textum uniformum formantibus: asci 350–400 × 13–15 μ, cylindracei: ascosporae 25–35 × 10–12 μ, uniseriatae, ellipsoideae vel oblongae, hyalinae, leves, globulis olearis: paraphyses filiformae, 2 μ diametro.

Ad ramos putridos dejectos in silva densa.

S.E. TIBET: Mönyul, Gyipu, Nyam Jang Chu, 2,550 m.; 24 March 1936, *Ludlow & Sherriff 1228.* (Herb. Brit. Mus., holotype).

This species differs from *S. coccinea* (Fr.) Cke. in its colour and in the possession of blunter spores and a very slight tomentum. Superficially it resembles *Peziza aurantia* Fr.

Spathularia flavida Fr., Syst. Myc. i: 491 (1821).

S.E. TIBET: Kongbo, Sang La, Tsangpo valley, 4,200 m.: 27 June 1938, *Ludlow, Sherriff & Taylor.*

Distribution: previously known from America, Europe, Siberia, Mongolia.

Chlorosplenium aeruginosum De Not., Disc. Comm. Critt. Ital.: 376 (1864).

S.E. TIBET: Pome, Trulung, 2,100 m.; on dead wood; 13 Jan. 1947, *Ludlow, Sherriff & Elliot 12138.*

Distribution: cosmopolitan.

Corynelia fructicola (Pat.) Höhnel in Sitzungsber. Kaiserl. Akad. Wiss. Wien, math.-naturwiss. Kl. cxx: 450 (1911).

Capnodium fructicolum Pat. in Journ. de Bot. iii: 258 (1889).

NEPAL: Maina, between Jajarkot and Jumla, 1,950 m.; on fruits of *Myrsine africana* L.; 6 Apr. 1952, *Polunin, Sykes & Williams 3865.*

Distribution: parasitic on *Myrsine* in India and China and on *Rapanea melanophlocos* R.Br. in S. Africa.

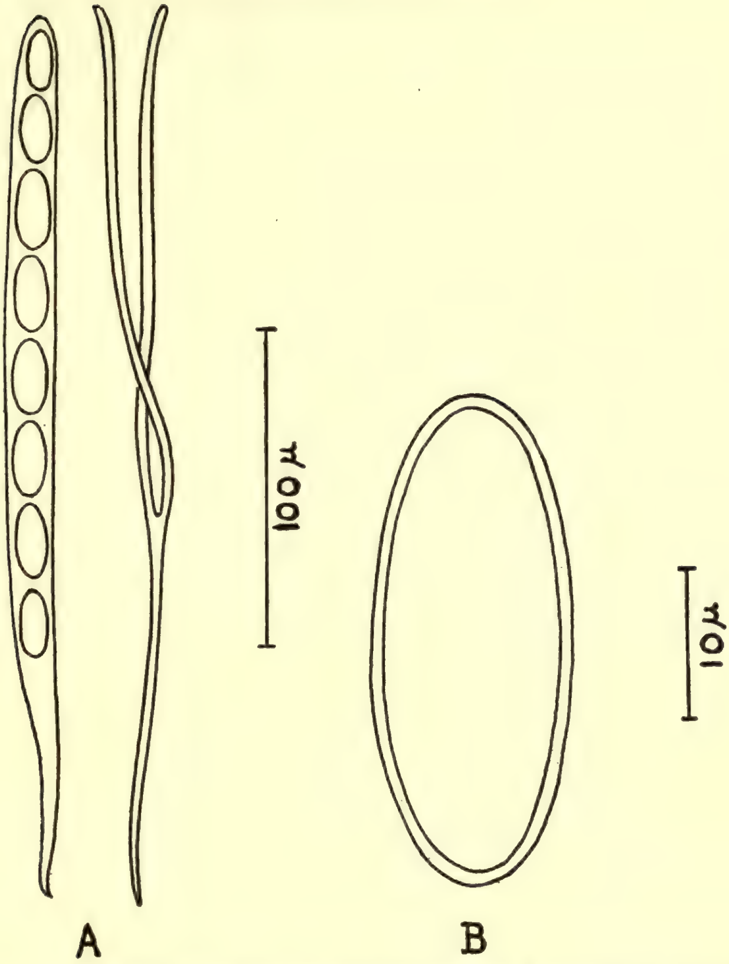

FIG. 5. *Sarcoscypha sherriffii* Balfour-Browne.
A. Ascus and paraphyses. B. Ascospore. Both A and B from *Ludlow & Sherriff 1228*.

Geoglossum ophioglossoides Sacc., Syll. Fung. viii: 43 (1889).

S.E. TIBET: Kongbo, Mira La, Nyang Chu, 3,600 m.; among dwarf *Vaccinium*; 17 Aug. 1938, *Ludlow, Sherriff & Taylor 6095.*

Distribution: cosmopolitan.

Tympanis spermatiospora (Nyl.) Nyl. in Not. Soc. Fauna Fl. Fenn. x: 70 (1869).

Patellaria spermatiospora Nyl. in Not. Soc. Fauna Fl. Fenn. iv: 125 (1858).

S.E. TIBET: Takpo, Lenda, Tsangpo valley, 3,300 m.; on *Populus* sp.; 8 May 1938, *Ludlow, Sherriff & Taylor 4175.*

Distribution: America, Europe and S.E. Tibet.

Taphrina deformans (Berk.) Tul. in Ann. Sci. Nat. Sér. 5, Bot. v: 128 (1866).

Ascosporium deformans Berk., Outl. Brit. Fungol. t. 1, fig. 9 *a*, *b* (1860).

NEPAL: Samela, 2,190 m.; causing distorted leaves in *Prunus* sp.; 4 Apr. 1952, *Polunin, Sykes & Williams 1855*.

S.E. TIBET: Migyitun, Tsari Chu, 2,550 m.; on *Prunus cornuta* (Wall.) Steud.; 28 May 1936, *Ludlow, Sherriff & Taylor 1722a*.

Distribution: cosmopolitan.

Taphrina pruni (Fuck.) Tul. in Ann. Sci. Nat. Sér. 5, Bot. v: 129 (1866).

Exoascus pruni Fuck., Enum. Fung. Nass. ser. 1: 29 (1860).

KASHMIR: Gund, Sind valley, 2,250 m.; on fruits of *Prunus padus* L.; 28 June 1940, *Ludlow & Sherriff 7692*.

Coleroa daphnes Balfour-Browne, sp. nov. (Fig. 6.)

Peritheciis hypophyllis, in greges orbiculares dispositis, superficialis, subcarbonaceis, atrobrunneis, globosis, 200–300 μ diam.; ostiolo inconspicuo; setulis rigidis, fuscis, non-septatis, apice acutis, basi incrassatis 65–75 × 5–7 μ: ascis cylindraceo-clavatis, brevissime stipitatis, 60–70 × 9–12 μ: sporidiis uni- vel bi-seriatis, fuscoideis, 1-septatis, non vel leviter constrictis, pallideolivaceis, 15–17 × 5–6·5 μ: paraphysibus indistinctis. In foliis vivis *Daphnes* sp.

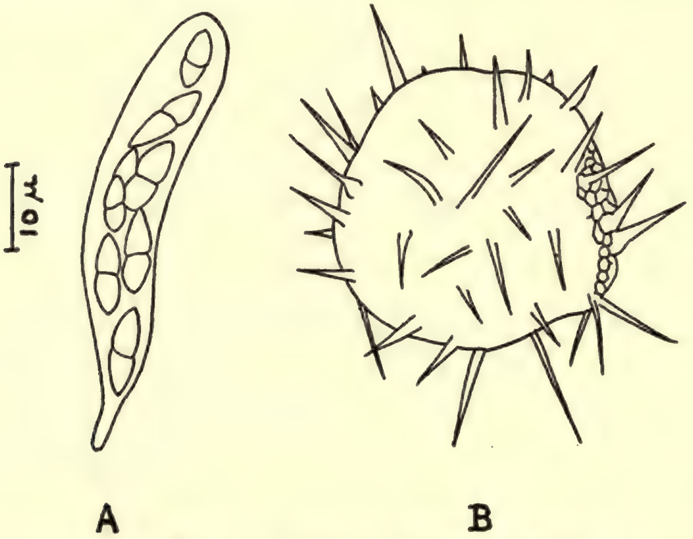

FIG. 6. *Coleroa daphnes* Balfour-Browne.
A. Ascus containing spores. B. Perithecium. Both A and B from *Ludlow, Sherriff & Taylor 5585a*.

S.E. TIBET: Kongbo, Tsari Sama, Langong, 4,200 m.; 16 June 1938, *Ludlow, Sherriff & Taylor 5585a*. (Herb. Brit. Mus., holotype).

This fungus is not unlike *Trichosphaeria macularis* Syd. & Butl. (Ann. Myc. ix: 402 (1893)) but differs by its septate spores and larger size.

Cordyceps sinensis (Berk.) Sacc., Michelia i: 320 (1878).

Sphaeria sinensis Berk. in Hook., Lond. Journ. Bot. ii: 207 (1843).

NEPAL: Chakure Lekh, south of Jumla, 4,200 m.; open turf slopes; 21 July 1952, *Polunin, Sykes & Williams 4832.*

BHUTAN: Phage La, 4,500 m.; 27 Aug. 1949, *Ludlow, Sherriff & Hicks 17208.* Collected by natives for export to India as a medicine.

S.E. TIBET: Kongbo, Nyima La, Tsangpo valley, 4,560 m.; 4 July 1938, *Ludlow, Sherriff & Taylor 5115.* Mira La, Gyamda Chu valley, 4,650 m.; 15 Aug. 1938, *Ludlow, Sherriff & Taylor 5115a*

Distribution: previously recorded from India and China.

Ophiobolus pangkarensis Balfour-Browne, sp. nov. (Fig. 7.)

Maculis amphiginis, angulatis, aurantio-brunneis: peritheciis hypophyllis, raro epiphyllis, sparse gregariis, innatis deinde plusminusque erumpentibus, obliquiter vel perpendiculariter in foliis directis, atris, globosis, carbonaceis imprimis ad apicem, clypeo absentis, 0·3 mm. diam.; ostiolo breviter papilliformi, ascis cylindraceis vel cylindraceo-clavatis, octosporis, breviter stipitatis, 100–120 × 15–18 μ: ascosporis parallelis vel fasciculatis, cylindraceis, vix curvulis, olivascentibus, 4–6 septatis, 80–90 × 4–5 μ: paraphysibus persistentibus, filiformibus, hyalinis, 3–4 μ crassis, apicibus interdum liberis.

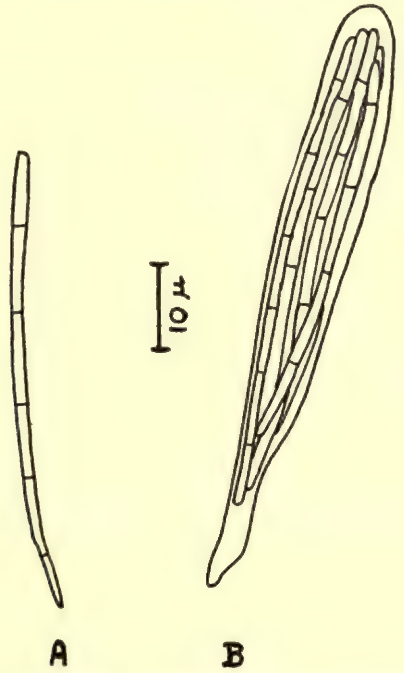

FIG. 7. *Ophiobolus pangkarensis* Balfour-Browne.
A. Ascospore. B. Ascus containing spores. Both A and B from *Ludlow, Sherriff & Taylor 6861.*

In foliis vivis *Salviae roborowskii* Maxim.

S.E. TIBET: Kongbo, Drukla Chu, near Pangkar, 3,450 m.; 20 Aug. 1938, *Ludlow Sherriff & Taylor 6861*. (Herb. Brit. Mus., holotype).

This fungus has been placed in the genus *Ophiobolus*, rather than in *Linospora*, on account of its non-clypeate perithecia, its very short or pappiliform and erect beak, its persistent papaphyses, some of which appear to be attached and others free, and its stipitate asci with walls which are not readily water soluble. On the other hand it is foliicolous whereas most described species of *Ophiobolus* are caulicolous.

Polystigma fulvum (Fr.) Chev., Fl. Gen. Env. Par. i: 458 (1826).

Dothidea fulva Fr., Syst. Myc. ii: 554 (1823).
Polystigma ochraceum Sacc., in Att. Soc. Veneto-Trent. Sci. Nat. 1875: 96 (1875).

NEPAL: Below Mugu, Mugu Khola, 3,450 m.; on leaves of *Cerasus* sp.; 24 Aug. 1952, *Polunin, Sykes & Williams 3019*.

Distribution: Europe and India.

Xylaria hypoxylon (Fr.) Grev., Fl. Edin.: 355 (1824) var. **hypoxylon**.

Sphaeria hypoxylon Fr., Syst. Myc. ii: 327 (1823).

BHUTAN: Pangkar, 2,700 m.; on old tree in dense rain forest; 24 Apr. 1949, *Ludlow, Sherriff & Hicks 18750*.

Conidial state only.

Distribution: cosmopolitan.

var. **tropica** Syd. & Butler in Ann. Myc. ix: 418 (1911).

NEPAL: Chutta, south-east of Jumla, 3,150 m.; among moss on fallen tree trunk; 27 Sept. 1952, *Polunin, Sykes & Williams 5417*.

Distribution: first described from Mysore. Also recorded from the Phillipines.

Differs from the normal form in having smaller spores, 9–12 × 3–5 μ.

FUNGI IMPERFECTI

Hendersoniella tibetica Balfour-Browne, sp. nov. (Fig. 8.)

Pycnidis gregariis, atris, erumpentibus vel superficialis, carbonaceis, globosis, 300–400 μ diam., per porum minutum dehiscentibus: conidiophoris hyalinis, filiformibus, flexuosis: conidiis olivaceis, ellipticis vel fusoideis, triseptatis, leviter constrictis, 13–16 × 3·5–5 μ.

In cortice *Ribis* sp.

S.E. TIBET: Kongbo, Molo, 315 m.; 19 May 1938, *Ludlow, Sherriff & Taylor 4334b*. (Herb. Brit. Mus., holotype).

Differs from the other species described for *Ribes* spp. in size and in the distinctly superficial pycnidia.

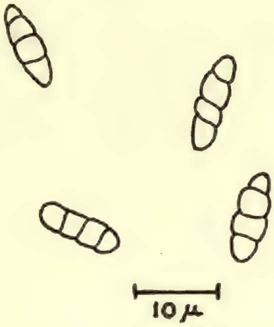

FIG. 8. *Hendersoniella tibetica* Balfour-Browne. Conidia from *Ludlow, Sherriff & Taylor 4334b*.

Melasmia acerina Lév. in Ann. Sci. Nat. Sér. 3, Bot. v: 276 (1846).

S.E. TIBET: Kongbo, Doshong La, Tsangpo valley, on leaves of *Acer caudatum* var. *multiserratum* (Maxim.) Rehd.; 22 Sept. 1938, *Ludlow, Sherriff & Taylor 4954c*. Kongbo, Tamnyen Chu, 3,000 m.; on same host; 24 June 1938, *Ludlow, Sherriff & Taylor 4974b*.

Distribution: America, Europe and S.E. Tibet.

Melasmia punctata Sacc. & Roum., Michelia ii: 632 (1882).

S.E. TIBET: Kongbo, Doshong La, Tsangpo valley, on leaves of *Acer caudatum* var. *multiserratum* (Maxim.) Rehd.; 22 Sept. 1938, *Ludlow, Sherriff & Taylor 4954c*. Kongbo, Tamnyen Chu, 3,000 m.; on same host; 24 June 1938, *Ludlow, Sherriff & Taylor 4974d*.

Distribution: America, Europe and S.E. Tibet.

Both the large black stromata of *M. acerina* and the smaller circinately grouped stromata of *M. punctata*, with their respectively larger and smaller conidia, occurred on many of the same leaves. The ascigerous stage had not yet developed in either species.

Trichoderma viride Fr., Syst. Myc. iii: 215 (1829).

S.E. TIBET: Kongbo, valley of Lilung Chu, west side of river, 3,160 m.; on fallen birch log; 24 May 1938, *Ludlow, Sherriff & Taylor 4450*.

Distribution: cosmopolitan.

Fumago vagans Pers., Myc. Eur. i: 9 (1822).

S.E. TIBET: Kongbo, Molo, 3,300 m.; on *Quercus aquifolioides* Rehd. & Wils.; 23 May 1938, *Ludlow, Sherriff & Taylor 3832*. Sang La, Tsangpo valley, 3,150 m.; on culms of *Bambusa* sp.; 15 July 1938, *Ludlow, Sherriff & Taylor 5835a*. Miling, Tsangpo valley, 3,000 m.; on *Rhododendron russatum* I. B. Balf. & Forrest; 23 Apr. 1947, *Ludlow, Sherriff & Elliot 12397*.

Distribution: Cosmopolitan.

Stroma broadly encrusting, superficial, fuliginous, dusty: hyphae not distinct from branching conidial chains: chains tapering apically, occasionally slightly curved: conidia cuboid to spherical, adhering, rarely becoming detached, fuliginous or brown, slightly warted, variable in size, 4–20 μ, average 14 μ: muriform conidia not seen.

It forms an extensive dusty coating over Bamboo, Rhododendron and other plants.

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A. H. G. ALSTON

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THE HETEROPHYLLOUS *SELAGINELLAE* OF CONTINENTAL NORTH AMERICA

By A. H. G. ALSTON

THIRTY of the fifty-five species dealt with in this paper are restricted to the area. *S. armata* Bak. occurs, however, in Florida and Cuba; *S. ovifolia* in British Honduras and the islands of Jamaica, Hispaniola, and Puerto Rico; and *S. microdendron* in Mexico, British Honduras, Guatemala, Cuba, and Jamaica. Such ranges are not unexpected, as Florida is believed to have been connected with Cuba;[1] and Puerto Rico, Hispaniola, and Jamaica with Honduras.[2] There is also a wide-spread species, *S. convoluta,* which is found in suitable dry areas from Yucutan and Hispaniola southwards to Paraguay. Another wide-spread species, also with a preference for relatively dry areas, is *S. marginata,* which is scattered over an area from Mexico to Paraguay. The implication seems to be that while the ranges of *S. microdendron* and *S. ovifolia* date from the Pliocene, the number of dry areas has probably increased since that period, and this has enabled the species which tolerate such conditions to extend their range. If the dry areas, which are widely separate, were of ancient date they might have been expected to possess endemic species. The South American element in the flora also includes *S. umbrosa* Lemaire which occurs from Mexico to Colombia and is, perhaps, doubtfully native in Tobago and Barbados, as well as *S. flagellata* and *S. diffusa,* both of which reach Trinidad. These three islands belong floristically to South America rather than to the West Indies. Of the species which are also found in South America, three reach their northern limit in Panama, one in Nicaragua, and ten in Mexico. Eight species are restricted to Mexico. *S. pilifera* is found only in a small area in north Mexico and just over the U.S. boundary, and the widespread *S. apoda* has some outlying localities in Mexico. These localities are similar to those given for other plants by Miranda and Sharp.[3] Four species reach their southern limit in Guatemala, one in Salvador, four in Honduras, one in Nicaragua, three in Costa Rica, and four in Panama.

This account has been based on the British Museum collection (BM) and on specimens on loan from the Botanisches Museum, Berlin-Dahlem (BD), the Jardin Botanique, Brussels (Br.), the Field Museum, Chicago (F), the Universitetets Botaniske Museum, Copenhagen (H), the Royal Botanic Gardens, Kew (K), the New York Botanical Garden (NY), the Muséum National d'Histoire Naturelle, Paris (P), the National Museum, Prague (Pr.), the Naturhistoriska Museum, Stockholm (St.), the Escuela Agricola Panamericana, Tegucigalpa (T), the Naturhistorisches Museum, Vienna (V), and the Smithsonian Institution, Washington (W). The author wishes to express his gratitude for the loan of this material.

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[1] C. Schuchert. *Historical Geology of the Antillean-Caribbean Region.* New York, 1935. Pp. 247–8, maps, t. 9.

[2] Op. cit. (1935), pp. 55, 107, and maps 14, 15.

[3] F. Miranda & A. J. Sharp. *Characteristics of Vegetation in Certain Temperate Regions of Eastern Mexico.* Ecology xxxi: 317 (1950).

KEY TO THE SPECIES

- Stems not articulate, rarely sulcate; rhizophores ventral:
  - Stems tufted, curling inwards when dry; leaves usually subcoriaceous:
    - Lateral leaves turning dark brown or reddish with age; median leaves obtuse or shortly mucronate:
      - Median leaves ciliolate, not margined; old leaves dark brown (Yucatan and Guatemala) . . 1. *convoluta*
      - Median leaves entire, margined:
        - Old leaves dark brown; median leaves with narrow margins and deciduous aristae (Tamulipas and Nuevo Leon) . . . . 2. *novoleonensis*
        - Old leaves reddish; median leaves obtuse, with broad white margins (Arizona to Salvador) . 3. *lepidophylla*
    - Lateral leaves turning pale (or light reddish) brown or straw-coloured with age; median leaves acute or aristate:
      - Median leaves lanceolate, not margined . . 4. *pilifera*
      - Median leaves ovate, white-margined:
        - Old leaves drying buff; leaves silvery beneath . 5. *pallescens*
        - Old leaves drying light reddish-brown; leaves dull green beneath . . . . 12. *microdendron*
  - Stems not tufted; leaves usually membranaceous:
    - Stems reddish at base, erect:
      - Leaves of main stem uniform, directed upwards; stems bright red:
        - Lateral leaves ciliate at base only . . . 6. *umbrosa*
        - Lateral leaves minutely and evenly denticulate on the upper margin . . . . . 7. *haematodes*
      - Leaves of main stem dimorphous, except at base of stem; stem pale reddish . . . . . 8. *hoffmannii*
    - Stems not reddish, or prostrate with reddish patches (*S. delicatissima*):
      - Leaves on main stems uniform:
        - Main stems erect; leaves membranaceous:
          - Branches (including leaves) about 15 mm. across; lateral leaves attached at posterior angle (i.e. not produced at base), strongly ciliate . 9. *bombycina*
          - Branches (including leaves) not exceeding 13 mm. across; lateral leaves attached more or less centrally:

Lower margin of lateral leaves truncate at base:

Lateral leaves strongly ciliate; axillary leaves oblong-lanceolate . . . . 10. *anceps*

Lateral leaves denticulate; axillary leaves lanceolate . . . . . . 11. *oaxacana*

Lower margin of lateral leaves rounded at base:

Lateral leaves of main stem ovate, not overlapping, and (except *S. illecebrosa*) sparingly ciliate at base:

Median leaves exauriculate:

Median leaves with broad white margins; microspores smooth or slightly verrucose:

Old leaves drying buff; leaves silvery beneath . . . . 5. *pallescens*

Old leaves drying light reddish-brown; leaves dull green beneath 12. *microdendron*

Median leaves not white-margined; microspores papillose:

Lateral leaves subequal on main stem or lower half of frond-like portion . . . . . . 13. *pulcherrima*

Lateral leaves dimorphous throughout frond-like portion . . 14. *illecebrosa*

Median leaves auriculate:

Median leaves mucronate, denticulate, short aristate . . . . . 15. *californica*

Median leaves aristate, ciliate, with arista more than half as long as lamina . . . . . . 16. *mosorongensis*

Lateral leaves of upper half of main stem spreading, and overlapping, closely ciliate . . . . 17. *viticulosa*

Main stems prostrate (and see no. 37 *S. mollis*); leaves subcoriaceous, glaucous green, rounded at apex, rarely apiculate . . . . 18. *schaffneri*

Leaves everywhere dimorphous, sometimes smaller at base of main stem:

Stems and/or branches without flagelliform apices; plants not soboliferous:

Stems prostrate, rooting throughout:

Median leaves denticulate, rarely with a few scattered cilia towards the base:

  - Median leaves with arista less than half as long as lamina; microspores without stalked papillae:
    - Lateral leaves pubescent on the upper surface . . . . . . 19. *lindenii*
    - Lateral leaves glabrous:
      - Lateral leaves obtuse, concave:
        - Microspores densely tuberculate . 20. *delicatissima*
        - Microspores rugose . . . 21. *douglasii*
      - Lateral leaves acute:
        - Median leaves with 3–4 rows of elongated colourless marginal cells . 22. *ludoviciana*
        - Median leaves with 1 (–2) rows of elongated marginal cells . . 23. *apoda*
  - Median leaves with arista nearly as long as lamina; microspores with stalked, capitate papillae . . . . 24. *tarapotensis*
- Median leaves ciliate in upper half:
  - Lateral leaves less than twice as long as broad:
    - Median leaves spaced, not white-margined . . . . . 25. *ovifolia*
    - Median leaves imbricate, white-margined 26. *reflexa*
  - Lateral leaves more than twice as long as broad, ciliate (except in no. 27 *guatemalensis*):
    - Rhizophores stout and straight; leaves herbaceous; microspores more or less reticulate, with high muri:
      - Lateral leaves diverging at 45°; median leaves ovate:
        - Median leaves acuminate, with narrow white margin; lateral leaves rounded at base, denticulate or shortly ciliate. . . 27. *guatemalensis*
        - Median leaves aristate, with broad white margin; lateral leaves subcordate, long ciliate . . . 28. *huehuetenangensis*
      - Lateral leaves forming a right-angle with the stem; median leaves suborbicular:
        - Upper surface of leaves glabrous; leaves not rolling up when dry . 29. *idiospora*

Upper surface of leaves usually pubescent; leaves becoming inrolled when dry . . . 30. *revoluta*

Rhizophores filiform; leaves membranaceous:

Median leaves narrowly elliptic; microspores verrucose . . . 31. *armata*

Median leaves obliquely ovate; microspores rugose . . . . 32. *schiedeana*

Stems suberect; rhizophores confined to the lower half of the stem:

Lateral leaves obliquely oblong:

Rhizophores filiform; leaves membranaceous:

Microspores with slender spines; sporophylls uniform . . . . . 42. *cladorrhizans*

Microspores smooth; sporophylls dimorphous . . . . . . 34. *lychnuchus*

Rhizophores stiff and straight; leaves herbaceous:

Arista of median leaves less than half as long as leaves; median leaves denticulate; sporophylls dimorphous . . 33. *stenophylla*

Arista of median leaves more than half as long as leaves; median leaves usually ciliate:

Sporophylls dimorphous . . . 34. *lychnuchus*

Sporophylls uniform:

Lateral leaves obtuse, not shining, rounded at base . . . 35. *martensii*

Lateral leaves subacute, shiny, cordate . . . . . 36. *estrellensis*

Lateral leaves ovate, subacute:

Lateral leaves without false nerves, glabrous on the upper surface; megaspores pale yellowish or white:

Lateral leaves ciliate:

Plants 3 or more inches high:

Erect stems springing from a wide-creeping, prostrate rhizome . 37. *mollis*

Erect stems shortly decurrent at base . . . . . . 40. *orizabensis*

Plants up to 1·5 inches high . . 38. *minima*

Lateral leaves denticulate . . . 15. *californica*

Lateral leaves with 2 false nerves, usually pubescent in lower half; megaspores dull reddish-brown . . . . . . 39. *porphyrospora*

Stems and/or branches with flagelliform apices, or plants soboliferous:

Lateral leaves ciliate; median leaves strongly auriculate; stems sparingly soboliferous at base, suberect, with rhizophores confined to the lower third:

Microspores smooth . . . . . 41. *novae-hollandiae*

Microspores with stalked papillae . . 37. *mollis*

Lateral leaves entire or ciliolate-denticulate; median leaves scarcely auriculate; stems and/or branches flagelliform; microspores smooth, warted, or spiny:

Branches with flagelliform apices or stems soboliferous; main stems rarely flagelliform:

Megaspores dull reddish-brown; lateral leaves with 2 false nerves, acute, upper surface usually pubescent in lower half; branches flagelliform, terminated by propagula or bulbils; microspores smooth or slightly warted 39. *porphyrospora*

Megaspores creamy or greyish-white; lateral leaves without false nerves, obtuse or subacute, glabrous; branches sometimes flagelliform; microspores with slender spines . . . . 42. *cladorrhizans*

Branches very rarely flagelliform; main stems normally flagelliform and rooting at tip; megaspores creamy white; lateral leaves without false nerves, glabrous; microspores not spiny . . . . 43. *flagellata*

Stems articulate; rhizophores dorsal:

Branches pubescent (Panama species):

Plant scandent; lateral leaves of branches 2·5 mm. long, those of main stem larger, distant, ascending 44. *exaltata*

Plant suberect; lateral leaves up to 7 mm. long, rather close, spreading . . . . 45. *articulata*

Branches glabrous:

Main stems simple, erect, with subequal leaves towards the base . . . . 46. *arthritica*

Main stems branched from the base, prostrate, or rarely ascending; leaves dimorphous throughout; lateral leaves spreading:

Lateral leaves subcoriaceous; median leaves broadly white-margined . . . . 47. *marginata*

Lateral leaves membranaceous; median leaves not conspicuously white-margined:

Main stems flagelliform at apex . . . 48. *sertata*

Main stems not flagelliform at apex:

Median leaves with two subequal auricles:

Auricles of median leaves very short; median leaves aristate; lateral leaves oblong; stems rooting in the lower two-thirds . . 49. *silvestris*

Auricles of median leaves large, equal to one quarter of lamina; median leaves acuminate; lateral leaves ovate-oblong; stems rooting in the lower third . . . 50. *galeottii*

Median leaves with one auricle or unequal auricles, one twice as large as the other:

Median leaves not acuminate; lateral leaves up to 2 mm. long . . . . . 51. *intacta*

Median leaves acuminate or aristate; lateral leaves about 4 mm. long:

Lateral leaves ovate-lanceolate, with large, long ciliate auricles:

Median leaves shortly auricled, often ciliate, somewhat acuminate . . 52. *diffusa*

Median leaves long auricled, not ciliate, shortly aristate . . . . 53. *horizontalis*

Lateral leaves narrowly oblong, with short ciliolate auricles:

Axillary leaves auriculate; lateral leaves parallel-sided:

Auricles of axillary leaves subparallel. 54. *eurynota*

Auricles of axillary leaves divergent . 55. *schizobasis*

Axillary leaves exauriculate; lateral leaves tapering towards the apex . 56. *kunzeana*

1. **Selaginella convoluta** (Arn.) Spring in Mart., Fl. Brasil. i, 2: 131 (1840); in Bull. Acad. Brux. x: 136 (1843).—Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 705 (1886).

'*Doradilla*' Titford, Sketches towards a Hortus Botanicus Americanus: ix, t. 13 fig. 5 (1812).
Lycopodium convolutum Arn. in Mem. Werner. Nat. Hist. Soc. v: 199 (1824); reimpr. in Mém. Soc. Hist. Nat. Par. i, 2: 347 (1824).[1]

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[1] *Lycopodium convolutum* (Beauv.) Desv. (1814) was published only in synonymy.

Lycopodium revolutum Hook. & Grev. in Hook., Bot. Misc. ii: 381 (1831) err. typ.
Selaginella longispicata Underw. ex Millsp. in Publ. Field Columb. Mus., Bot. Ser. i: 287, t. 10 (1896).—Hieron. in Hedwigia lviii: 286 (1917).—Millsp. in Publ. Field Mus. Nat. Hist., Bot. Ser. iii: 197 (1930).—Boys, Ethno-Bot. Maya: 266 (1931).
? *Ceterach officinarum* sensu Ramirez, Pl. Mex.: 75 (1902); non DC.

MEXICO. Yucatan: without exact locality (ex Titford); at the base of the Eastern hills, where it invests fissures of the larger rocks, *Valdez 50* (BM; NY; W); forest land near Izabal, *Gaumer 825* (type of *S. longispicata*, BM; NY; W); Muna, in crevices along stony trail, *Steere 2171* (W); Nohcacab and Mérida, *Schott 669* (BM; W).

GUATEMALA. Montagua, *Godman & Salvin 146* (K; NY).

HONDURAS. Crevices of rocks, along Río Yeguare, near Galeras, El Paraíso, 850 m., *Williams & Molina 14910* (W).

Geographical range: Yucatan, Honduras, Cuba and Hispaniola southwards to Paraguay and Bolivia. Type from Brazil.

'Doradilla' is given as the Spanish name by Titford and Millspaugh. It is, however, applied to many other species of pteridophytes including *S. lepidophylla*, and seems originally to have been a name for *Ceterach*. Schott and Gaumer give 'Mutscoc' as the Maya name; this should be 'X-much-coc' according to Boys, meaning 'dried pectoral', a name applied equally to *S. pallescens*. It is used in village medicine for the treatment of catarrh. Ramirez, on the authority of Doudé, gives 'Xmuchcoc' for *Ceterach officinarum*.

2. **Selaginella novoleonensis** Hieron. in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 676 (1901); in Hedwigia xli: 173 (1902).—Davis, Life of Pringle: 332,506 (1936).

Selaginella pilifera sensu Davis, Life of Pringle: 60, 332, 501, 506, 673 (1936); non A. Braun.

MEXICO. Tamaulipas: limestone ledges, Cerro de los Armadillos, near San José, Sierra de San Carlos, *Bartlett 10177* (BM; W); barren rocky cliffs and banks of Rio San Marcos, west of Ciudad Victoria, *Meyer & Rodgers 2510* (BM); mountains above Ciudad Victoria, *Orcutt 367* (BM). Nuevo Leon: limestone ledges, near Monterey, *Pringle 2038* (NY); limestone ledges, near Sierra de la Silla, Monterey, *Pringle 2489* (BM; NY; W); 70 km. north of Monterey, 500 m., *Copeland 173* (BM).

Geographical range: confined to the limestone areas of Tamaulipas and Nuevo Leon, Mexico.

A specimen from 'mountains near Ciudad Victoria, Tamaulipas' (*Orcutt 367* (W)) has rather reddish leaf-bases towards the apex of the shoots and approaches *S. lepidophylla*. The specimens from Sonora (damp shady rocks, Huehuerachi, *Lloyd 506* (NY; W), and base of cliff near summit, 1,050–1,150 m., ridge south of Arroyo Gochico, east of San Bernardo, *Pennell 19553* (W)) are also somewhat intermediate.

3. **Selaginella lepidophylla** (Hook. & Grev.) Spring in Mart., Fl. Brasil. i, 2: 126 (1840); in Bull. Acad. Brux. x: 137 (1843).—T. Moore in Gard. Chron. 1872: 1068, figs. 252 and 253 (1872).—Wats., Bot. Calif. ii: 350 (1880).—Orcutt, Check-List Fl. Pl. S. and L. Calif.: 12 (1885).—Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 707 (1886).—Wittrock in Act. Hort. Berg. i, 8: 47, t. 4 (1891).—Hieron. in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 675, fig. 403 (1901).—Bray in Bot. Gaz. xxxii: 286 (1901).—Clute, Fern Allies: 163 cum fig. (1905).—Balthis in Amer. Bot. xxi: 52 cum 2 fig.

(1915).—Palmer in Amer. Fern Journ. ix: 21 (1919).—Maxon in Amer. Fern Journ. xiii: 74 (1923).—Domin, Pteridophyta in Nová Encykl.: 55, fig. 28 (1929).—Hegi, Ill. Fl. Mittel-Europ. vii: 33 (1931).—Johnston in Journ. Arn. Arb. xxiv: 328 (1943).—Conzatti, Fl. Tax. Mex. i: 140 (1946).—Phillips in Amer. Fern Journ. xxxvii: 49 (1947).—A. Tryon in Ann. Miss. Bot. Gard. xxxvi: 423, t. 30 fig. 31 (1949).

Lycopodium lepidophyllum Hook. & Grev. in Hook., Bot. Misc. iii: 106 (1833); Hook., Ic. Pl. ii: tt. 162, 163 (1837).—Meisn. in Linnaea xii: 157, t. 3 (1838).

Lycopodium circinale sensu Mart. & Gal. in Mém. Acad. R. Brux. xv: 10 (1842); in Compt. Rend. Acad. Sc. xviii: 502 (1844); non L.

? *Selaginella thoytsiana* Curd in Proc. Roy. Hort. Soc. iii: 285 (1863), *nom. nud.*

Selaginella rediviva Forrer ex Wittrock in Act. Hort. Berg. i, 8: 48 (1891) in syn.

? *Lycopodium nidiforme* Sessé & Mociño, Fl. Mex. ed. 2: 289 (1894).

UNITED STATES. Arizona: (ex Clute and Phillips). New Mexico: foothills of the Magdalena Mts., *Ferriss* (ex Maxon); San Andreas Range, *Ferriss* (ex Maxon). Texas: *Wright 827* (BM); Sierra Blanca, *Mulford 266* (K); Del Rio, Valverde Co., *Palmer 12364* (ex ipse); Devil's River, Valverde Co., *Palmer 11366* (ex ipse); Montell, Uvadale Co., *Palmer* (ex ipse); Trans Pecos region, also eastward on limestone bluffs to the Frio R. (ex Bray).

MEXICO. Lower California: (ex Wittrock, Watson, and Orcutt). Sonora: Sierra Madre, *Seeman* (BM). Chihuahua: Santa Eulalia Mts., *Pringle 203* (BM; NY). Coahuila: General Sepada, *Palmer 327* (NY). Nuevo Leon: Monterey, *Palmer 1439, 1440* (ex Hemsl.). Tamaulipas: near Tampico, *Palmer 245* (NY); near S. Vincente-Jaamave, *Rozynski 42* (NY). Zacatecas: Cedros, rocky hills, *Kirkwood 134* (ex Johnst.). San Luis Potosi: *Schaffner 14* (NY); Escobrillos Mts., *Schaffner 935* (NY). Nayarit: San Blas, *Dundas* (ex Hook. & Grev., type); Rincon de Mateo, near Yxtlan, 1,100 m., *Mexia 770* (BM; NY); Ixtlan, *Jones 23493* (NY). Jalisco: La Barranca, Guadalajara, *Jones* (BM; NY); near Rio Blanco, Guadalajara, *Rose & Painter 7498* (BM); near Guadalajara, *Pringle 11275* (NY). Queretaro: near Queretaro, *Rose 11198* (NY). Colima: Manzanillo, *Palmer 1401* (NY). Michoacan: (ex Mart. & Gal.). Mexico: Bejucos, Distr. Temascaltepec, *Hinton 7388* (BM). Morelos: Cuernavarca, *Schmitz* (ex Hemsl.). Puebla: San Lorenzo, near Tehuacan, *Liebmann* (H); Sierras, Acheté, near Puebla, *Arsène* 1926 (W). Oaxaca: near San Luis Tultitlanapa, Puebla, *Purpus 3155* (BM; NY; W); Santa Catarina, *Rusby 83* (NY).

SALVADOR. Near Cuisnagua, *Hayes* (BM).

Geographical range: confined to Arizona, New Mexico, Texas, Mexico and Salvador.

Hooker's record for Peru, *Alex. Caldcleugh*, was doubtless an error of locality. Hooker himself stated (Ic. Pl.: t. 162) that Caldcleugh's specimen was from Mexico, and that specimens later formed an article of commerce between Mexico and Peru. In addition to Mexico and Peru Spring gives California, *Gaudichaud*, which probably refers to Lower California. However, Gaudichaud was never in Mexico or California. Luerssen's record for Hawaii (Honolulu, *Wawra 2517*) in Flora lviii: 440 (1875) was stated to be an error by Luerssen himself (Flora lix: 302 (1876)).

The Mexican name is given as 'Siempreviva' by several authors and as 'Flor de la Peña' by Johnston. Martens and Galeotti give 'Flor de piedra' and in Michoacan 'Doradilla'.

An extract was at one time sold in Germany under the name 'Pnigodin' as a remedy for whooping-cough (Pharmaz. Zeit. lix: 92 (1914)).

There is no specimen from Arizona in Clute's herbarium at Butler University (letter from Prof. J. E. Potzger 25.xi.1952) and the basis of his record is unknown.

The remarkable spirally twisted axis has been figured and described by Wojinowić (Beiträge zur Morphologie, &c., der S. lepidophylla, Dissertation 1890: 6–7, t. 1, fig. 3). The morphological explanation of this peculiar type of axis is that the apex branches dichotomously, and while the right-hand branch of the dichotomy grows more vigorously and forms a radial side-shoot, the left-hand branch continues to grow forward and slightly upwards, at the same time curving spirally inwards. After a time this shoot again forks dichotomously, with the left-hand branch again growing forward as before. As this process is indefinitely repeated, the left-hand branches form a corkscrew-like spiral 'main stem', while the right-hand branches radiate out to form the rosette of spirally arranged frond-like branch-systems. It is these branches which curl inwards to form the familiar ball-like structure which is seen in dry weather.

4. **Selaginella pilifera** A. Braun in Index Sem. Hort. Bot. Berol., 1857, App.: 20.—Hemsl. in Biol. C.-Amer. iii: 708 (1886).—Stahl in Karsten & Schenck, Vegetationsbilder ii, 4: t. 21 (1904).—Clute, Fern Allies: 164 (1905).—'A.O.' in The Garden lxvii: 210 cum fig. (1905).—Johnst. in Journ. Arn. Arb. xxiv: 328 (1943).—Conzatti, Fl. Tax. Mex. i: 141 (1946).—A. Tryon in Ann. Miss. Bot. Gard. xxxvi: 423, t. 30, fig. 32 (1949).

Selaginella pringlei Bak. Fern Allies: 88 (1887).—Clute, Fern Allies: 163 (1905).—Davis, Life of Pringle: 20, 332 (1936).—Conzatti, Fl. Tax. Mex. I: 141 (1946).
Selaginella pilifera var. *pringlei* (Bak.) Morton in Amer. Fern Journ. xxix: 15 (1939).

UNITED STATES. New Mexico: Guadalupe Mts., *Goodding 803* (ex Morton). Texas: Chenates, *Neally 557* (NY); Upper McKittrick Canyon, Guadalupe Mts., 1,980 m., *Moore & Steyermark 3502* (BM); mountains below El Paso, *Wright* (ex A. Braun); high rocky bluffs of Devils' R., Val Verde Co., *Wright* s.n. (ex Johnst.).

MEXICO. Sonora: Valley of Rio Bavispe, *White 522* (ex Johnst.). Chihuahua: Santa Eulalia Mts., *Pringle 271* (BM; NY; W, type-collection of *S. pringlei*), *886* (NY), *Wilkinson* (W); Sierra Almagre, *Johnston & Muller 1140* (ex Johnst.). Coahuila: in crevices of dry, sloping rocky walls of cañon, Saltillo, *Palmer 321* (NY; W), *Arsène 10677* (W); Yerda Spring, near Muzquiz, *Marsh 270* (ex Johnst.); Muzquiz-Mariposa, *Marsh 1042* (ex Johnst.); western end of Sierra Fragua, *Johnston 8748* (ex Johnst.). Nuevo Leon: Montemorelos, *Nelson 6700* (W); near Monterey, *Pringle 2041* (NY), *11276* (NY; W), *Dodge 120* (W), *Orcutt 1234* (W); rocky limestone bank, 800–900 m., Hacienda 'Vista Hermosa', south of Villa Santiago, *Pennell 16927* (W); Sierra Madre above Monterey, 920 m., *Pringle 13959* (W). Tamaulipas: limestone ledges, Cerro de los Armadillos, near San José, *Bartlett 10176* (W). San Luis Potosi: *Parry & Palmer 1008* (W); rocky sandstone west of San Luis Potosi, 1,900–2,100 m., *Pennell 17636* (W); rock faces near falls, El Salto, beyond Meco, 12 km. north of Antiguo Morelos–Ciudad Maiz highway, *Moore & Gatty 5008* (BM).

The type-specimen of *S. pilifera* was cultivated in Berlin. There is a duplicate at the British Museum. Braun also mentioned Wright's specimen.

Geographical range: confined to the extreme south of New Mexico, south-west Texas, and northern Mexico.

Johnston states that *S. pilifera* is found on sheltered, moderately moist cliffs in the oak belt, but not with *S. lepidophylla* on the lower and open slopes of the mountains.

Morton (op. cit.: 15) states that in *S. pilifera* the outer margin of the lateral leaves is serrulate at the apex, and that of *S. pringlei* quite entire. I find the median leaves of the type-collection of *S. pringlei* to be serrulate and the distinction, therefore, appears insufficient even for a variety.

5. **Selaginella pallescens** (Presl) Spring in Mart., Fl. Brasil. i, 2: 132 (1840).—Knobloch in Amer. Fern Journ. xxxii: 137 (1942).

Lycopodium pallescens Presl, Rel. Haenk. i: 79 (1825).

Lycopodium cuspidatum Link, Hort. Berol. ii: 161 (1833).—Kunze in Linnaea xiii: 151 (1839); op. cit. xviii: 304 (1844).

Selaginella cuspidata (Link) Link, Fil. Spec. 158 (1841).—Watson in Proc. Amer. Acad. Art. Sci. xxi: 445 (1886).—Loesen. in Bull. Herb. Boiss. Ser. 2, iii: 83 (1903).—Donn. Smith, Enum. Pl. Guat. iv: 179 (1895); op. cit. vii: 65 (1905).—Maxon in Contr. U.S. Nat. Herb. xiii: 23 (1909).—Conzatti Fl. Tax. Mex. i: 140 (1946).

? *Selaginella incana* Spring in Mém. Acad. R. Belg. xxiv: 157 (1850).

? *Selaginella sulcangula* Spring in Bull. Acad. Brux. x: 137 (1843);—in Mém. Acad. R. Belg. xxiv: 163 (1850) pro parte excl. planta jamaicensis.

Selaginella emmeliana v. Geert in Rév. Hort. Belg. x: 220, fig. 20 (1884).

Selaginella cuspidata var. *elongata* Spring in Mém. Acad. R. Belg. xxix: 67 (1850).—Hieronymus in Engl., Bot. Jahrb. xxxiv: 577 (1904).—Christ in Bull. Herb. Boiss. sér. 2, vi: 288 (1906).—Hieron. in Verh. Bot. Verh. Brandenb. li: 10 (1910).—Maxon & Standl. in Proc. Biol. Soc. Wash. xliii: 178 (1930).—Conzatti Fl. Tax. Mex. i: 140 (1946).

Selaginella lepidophylla sensu Donn. Smith, Enum. Pl. Guat. iv: 179 (1895); non Spring.

Lycopodium circinale sensu Schlecht. & Cham. in Linnaea v: 622 (1830); non L.

Selaginella pulcherrima sensu Fourn., Mex. Pl. 147 (1872) pro parte; non Liebm.

MEXICO. Without exact locality, *Haenke* (Pr., type of *L. pallescens* Presl; photo BM). Sonora: Sierra de Alamos, *Rose, Standley & Russell 12859* (NY); Caramechi, *Gentry 1197* (BM). Chihuahua: SW. Chihuahua, *Palmer 85* (BM; NY); Mojarachic (ex Knobloch). Nuevo Leon: Sierra Madre, near Monterey, *Pringle 1979* (BM; NY). Sinaloa: La Noria, in shady, damp places, 245 m., *Mexia 221* (BM); Panuco, 700–750 m., *Pennell 20184* (W); San Ignacio, *Ortega 366* (K), *430* (K). Tamaulipas: San José, *Kemp* (NY). Durango: near Durango, 1,900 m., *Palmer 886* (BM; NY). San Luis Potosi: Alvarez, *Palmer 179* (NY); San Francisco, *Schaffner* (NY); San Miguelito Mts., *Schaffner 13* (NY); Tamasunchale, 250 m., in brush on limestone cliff, *Copeland 172a* (BM); near San Luis Potosi, *Parry & Palmer 1009* (K). Tepic: *Palmer 1936* (NY); Cerro de la Cruz, near Tepic, damp places and shady thickets, 1,000 m., *Mexia 653* (BM; NY); woodland on hill east of Tepic, 950–1,000 m., *Pennell 19954* (W); shaded bank, 700–750 m., Trapichillo, *Pennell 19831* (W). Jalisco: Near Guadalajara, shaded banks, *Pringle 2592* (BM; NY), *2037* (NY). Vera Cruz: Zacuapan, *Purpus 6193A* (BM), *8253* (W), *8258* (NY), *8925* (BM; NY); 1,000 m., *J. Purpus 126* (BM); Barranca de Zacuapan, *Purpus 5791* (BM; NY); Barranca de Tenompa, Zacuapan, 900 m., *J. Purpus 125* (BM); Cordoba, *Müller 259* (NY);

Orizaba, *Bourgeau 2549* (K), *2769* (BM; K; NY), *Hahn 2540* (K), *Müller 365* (NY), *425* (NY); *Seaton 307* (NY); *Botteri 77* (BM), *Copeland 172* (BM); Mirador, *Sartorius* (NY), *Linden 86* (K), *J. Purpus 129* (W); Jalapa, *Schiede* (BM), *825* (NY), *Orcutt 2808* (BM); woods of Rio Blanco, Orizaba, *Bourgeau 2540* (NY; W). Colima: Alzada, *Orcutt 4651* (BM); Nevado de Colima, *Gadow* (BM); Tuxpan Cañon, *Orcutt 4690* pro parte (W). Michoacan: Cerro Azul, near Morelia, *Arsène 3375* (BM); slopes of Jorullo Volcano, *Eggler 144* (BM); walls, Yácatas, Iguatio, *Seler 1232* (ex Loesen.). Mexico: Near Tlalpam, *Pringle 9282* (NY), *Rose & Painter 6455* (NY), *Orcutt 3626* (BM); near Mexico, *Schmitz* (K); Valle de México, *Schaffner 934* (NY); San Angel, *Schaffner 13* (BM; NY); Luvianos, Distr. Temascaltepec, *Hinton 3974* (BM). Morelos: Cuernavaca, *Gadow* (BM); Xochicalco, Distr. Cuernavaca, *Seler 384* (ex Hieron.). Guerrero: Rio Balsas, *Lautrappe* (NY), *Orcutt 4230* (BM); Cañon de la Mano, Iguala, *Gadow* (BM); summit of mountains between Chilpancingo and Tixtla, *c.* 1,830 m., *Moore 5245* (BM); below Tierra Colorado on highway to Acapulco, 215 m., on shaded rocks, *Moore 5267* (BM); granitic soil between Acahuizotla and Agua de Obispo, moist rocks in stream, *c.* 900 m., *Moore 5114* (BM); on wet, shaded lime rocks, between Santa Ana and Chapulhuacán, 1,160 m., *Moore 5080* (BM). Oaxaca: Sierra San Pedro Nolasco, *Jürgensen* (BM); between San Juanito and Trinidad, 440 m., *Mexia 9295a* (BM); on rocks, Arroyo Culebras, Yaveo, District Choapam, 450 m., *Mexia 9190* (BM). Chiapas: *Ghiesbreght 608* (BM); Cascada Siltepec, *Matuda 1727* (W); Siltepec, *Matuda 229* (W).

British Honduras. Soil pockets on granite, banks of Rio Frio, Mountain Pine Ridge, El Cayo Distr., *Lundell 6700* (W).

Guatemala. Without exact locality, *Tonduz 686* (BM; NY), *752* (BM; NY), *Skinner* (K); north of Sebol, 200–300 m., *Steyermark 45767* (BM); Volcan de Fuego, *Salvin & Godman 189* (K); near Purula, *Maxon & Hay 3369* (NY); near S. Rosa and Jalapa, 400–1,000 m., *Lehmann 1675* (BM); Cerro de Agua Tortuga, near Cubilgüitz, 350–450 m., *Steyermark 44592* (BM); Dept. Alta Verapaz, *Türckheim II. 1386* (NY); Tactic, *Türckheim 8486* (NY), 1,525 m., *Johnson 992* (BM); Río Cobán, 1,220 m., *Johnson 664* (BM); Sapoti, *Bernoulli 257* (K); on dry ridge, SE. of Pueblo San Jorge, Dept. Solalá, *Hatch & Wilson 309* (W); near Nucapuxlac, Dept. Huehuetenango, 2,500 m., *Steyermark 48951* (BM); Río Sitio Nuevo, 1,200–1,500 m., Dept. Zacapa, *Steyermark 42201* (BM), *42202* (BM); SW. of Lanquín, 600–1,000 m., *Steyermark 44135* (BM); on rocks, near San Mateo Ixtatán, Sierra de los Cuchumatanes, 3,100 m., *Steyermark 49890* (BM); on rocks by stream, Cuilco, 1,200–1,300 m., *Steyermark 50888* (BM); rocky slopes above San Ildefonso Ixtahuacán, 1,600–1,700 m., *Steyermark 50661* (BM); Volcán Santa Clara, Dept. Suchitepéquez, 1,250–2,650 m., *Steyermark 46595* (BM); Volcán Atitlán, 1,700–3,800 m., Dept. Sololá, *Steyermark 47428* (BM); between Cobán and Finca Chimoté, 800–1,500 m., *Steyermark 44174* (BM); near Finca Piamonte, Dept. El Progreso, 2,400–2,500 m., *Steyermark 43407* (BM); between Calera and Volcán Siglo, 2,000–2,200 m., *Steyermark 42994* (BM).

Salvador. Near Tonacatepeque, Dept. San Salvador, *Standley 19510* (NY); San Salvador, *Calderón 186* (NY), *937* (NY), *1740* (NY), *Standley 19191* (NY), *23277* (NY); Dept. Santa Ana, *Calderón 1924* (NY); near San Vicente, Dept. San Vicente, *Standley 21197* (NY); Cuscatancingo, *Calderón 911* (NY).

HONDURAS. On dripping cliff in pine forest, near Siguatepeque, Dept. Comayagua, 1,100 m., *Yuncker, Dawson & Youse 5697* (W), 1,050 m., *5719* (BM; W), *5572* (W), *5722* (BM; W); Dept. of El Paraiso, 3 km. west of Guinopé, 1,400 m., *Williams & Molina 10310* (BM).

NICARAGUA. Santiago Volcano, near Masaya, 300–480 m., *Maxon 7657* (BM; W), *7668* (W); Laguna de Masaya and vicinity, about 300 m., *Maxon 7748* (W); shaded rocks of stream bed in ravine, Punta Chiltepe, Tamagasta Terr., west of Managua *Maxon, Harvey & Valentine 7332* (W).

COSTA RICA. Guanacaste, *Rowlee 129* (NY); forests of Nicoya, *Tonduz 13762* (BM); banks of Rio Torres, *Tonduz 1297* (BM); Cartago, Prov. Cartago, *Cooper 6061* (NY), *Maxon 31* (NY), *35* (NY), 1,295 m., *Donnell Smith 5102* (K); Dulce Nombre, Prov. Cartago, 1,400 m., *Standley 35886* (W); near Santiago, *Maxon 93* (NY), *94* (NY); S. José, 1,400 m., *Brade* (ed. Rosenstock) *73* (BM); Cerro de Piedra Blanco, above Escasu, Prov. S. José, *Standley 32439* (W).

PANAMA. Chiriqui Volcano, *Seemann 1558* (BM); near El Boquete, Chiriqui, 1,000–1,500 m., *Cornman 830* (W), *1152* (W), *1346* (W); forests of Cerro de Lino, above El Boquete, 1,300–1,560 m., *Pittier 3030* (NY; W); valley of the upper Rio Chiriquí, Viejo, near Monte Lirio, 1,300–1,900 m., *Seibert 311* (W); Campana Hill, 800 m., rocks at summit, *Alston 8927* (BM).

Geographical range: northern Mexico, southwards to northern Colombia and Venezuela. Also recorded from Surinam by Hieronymus (Hedwigia lviii: 286 (1917)).

The records for Cuba and Jamaica by Hieronymus (loc. cit.) appear to be due to confusion with *S. microdendron* and *S. convoluta*. *S. cuspidata* (Link) Link was described from specimens cultivated in the Berlin Botanical Garden. *S. emmeliana* v. Geert was also from a cultivated specimen, named after Mr. Emmel of Nuremberg: it was found wild by his brother in 'Quinquina woods in S. America': it appears as *S. Emiliana* in Bull's Catalogue no. 225 (1886). *S. incana* Spring was described from specimens from Guatemala (*Skinner*), and *S. sulcangula* Spring from Caracas (*Plée*). Spring does not compare them directly with his *S. cuspidata*, which is put under 'A. *Foliis atque ramulis convolutis*', while the other species are under 'B. *Foliis atque ramis siccitate planis*'. *S. sulcangula* is, however, described as '*siccitate subconvolvenda*', and there appears to be a wide range of variation in this respect which is related to the humidity of the habitat of the individual specimen.

S. microdendron Bak. is easily confused with this species.

forma **aurea** (J. Hill) Alston comb. nov.

Selaginella emiliana var. *aurea* J. Hill in Gard. Chron., ser. 3, xliv: 253 (1908).—in Journ. R.H.S. xxxiv: ccxxxv (1909).

A golden-green form known in cultivation.

6. **Selaginella umbrosa** Lemaire ex Hieron. in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 683, fig. 404 (1901); in Hedwigia lviii: 287 (1917).—Lundell, Veg. Peten: 195 (1937).

Selaginella lemairei Hieron. in Hedwigia lviii: 287 (1917), *nom. provis.*
Lycopodium umbrosum Lemaire ex Kunze in Linnaea xxiii: 292 (1850) in syn.
Selaginella erythropus var *major* Spring in Mém. Acad. R. Belg. xxiv: 156 (1850).

Selaginella erythropus sensu Hemsl. in Godman & Salvin, Biol C.-Amer. iii: 705 (1886); non Spring.—Donn. Smith, Enum. Pl. Guat. ii: 92 (1891).—Millsp. in Publ. 279, Field Mus. Nat. Hist., Bot. Ser. iii, 3; 197 (1930).

MEXICO. Yucatan: *Gaumer 23171* (ex Millsp.).

BRITISH HONDURAS. *Record* (BM; W), *Morris* (K); Roaring Creek, *Lundell 395* (BM; NY; W); Stann Creek, *Schipp 51* (BM; NY); Big Creek, *Schipp 51* (W); Melinda, *Robertson 144* (BM); Red Cliff, *Robertson 245* (BM); Stann Creek District, *Stocker 1929* (W); Gracie Rock, Sibun R., *Gentle 1552* (W); Cohune Ridge, Single Hill Creek, Mantee R., *Bartlett 11322* (W).

GUATEMALA. *Skinner* (type of var. *major* Spring, K); near Quirigua, Dept. Izabal, *Standley 22460* (NY; W), *23748* (NY; W); Quebradas, Dept. Izabal, *Pittier 8583* (NY; W); Los Amates, Dept. Izabal, *Kellerman 7250* (NY); Sierra de Mica, *Bernoulli 165* (K); near Escoba, Dept. Izabal, *Standley 24839* (NY; W); Jocoló, 30 m., on banks, Dept. Izabal, *Johnson 988* (BM); Monte Cachirulo, Dept. Izabal, 275 m., *Donnell Smith 1574* (K; W); shady bank, Cerro de Las Minas, Los Amates to Izabal, Dept. Izabal, *Blake 7808* (W); lowland jungle, Rio Dulce, *Muenscher 12171* (W); Quirigua, Dept. Izabal, *Cockerell* (W); near Escoba, on bay opposite Puerto Barrios, Dept. Izabal, 150 m., *Standley 24840* (W); along Rio Frio, Dept. Izabal, 50–75 m., *Steyermark 39947* (BM), *41629* (BM); along Rio Santa Isabel, Dept. Petén, 100 m., *Steyermark 45828* (BM); Izabal, *Salvin & Godman* (K), *Bernoulli & Cario 164* (K), Hacienda El Limon to El Paraiso, Dept. Copan, *Blake 7358* (W); trail to El Limon, *Blake 7339* (W); on rocks, Hac. El Limon, *Blake 7346* (W).

HONDURAS. Puerto Serra, *Wilson 91* (NY), *217* (NY); near Lancetilla, *Yuncker 4952* (BM); Cuyamel, *Carleton 596* (W); very common on hills, Lancetilla Valley, *Chickering 20* (W); Tela, on bank of Colorado R., 30 m., in sandy clay, *Dyer A. 233* (W); Lancetilla, near Tela, *Ames 55* (W), *178* (W), *Standley 52755* (W), *54595* (W).

COSTA RICA. Livingston, *Rowlee 33* (NY; W); Siquirres, near sea-level, *Wercklé 596* (W); wet forest, Finca Montecristo, on the Rio Reventazón below Cairo, Prov. Limon, near sea-level, *Standley & Valerio 48602* (W).

PANAMA. Near Laguna de Chiriquí, *Hart 11* (K; W); along Chavavé R., above Chepo, Prov. Panama, near sea-level, *Pittier 4720* (W); between Colon and Empire, *Crawford 536* (BM; NY; W); forest along the Rio Indio de Gatun, Canal Zone, near sea-level, *Maxon 4820* (BM; W); forests around Porto Bello, Prov. Colon, near sea-level, *Pittier 2489* (W); along Rio Fató, Prov. Colon, *Pittier 3885* (W); around Dos Bocas, Rio Fató valley, Prov. Colon, near sea-level, *Pittier 4220* (W).

Geographical range: Yucatan and British Honduras to Panama and Colombia (*Schlim 660* and *Kalbreyer 99*).

It seems possible that this is only an introduced plant in Tobago and Barbados; it is common in cultivation.

S. erythropus (Mart.) Spring is a smaller species found in Brazil and along the Andes from Peru to Colombia.

7. **Selaginella haematodes** (Kunze) Spring in Mart., Fl. Brasil. i, 2: 126 (1840).

Lycopodium haematodes Kunze in Linnaea ix: 9 (1835); Farrnkr. ii: 61, t. 30 [excl. fig. C] (1840–7).

PANAMA. *Herb. Miller* (BM), *Hayes 72* (NY); Gatun, *Hayes 41* (BM); Frijoles, Canal Zone, *Cook & Martin 54* (W); Barro Colorado I, *Bailey 416* (W), *Kenoyer 62* (W), *Standley 40957* (W); Cana, 1,065 m., *Williams 895* (NY); near Cana, 600 m., *Goldman 1885* (W); forests around Porto Bello, Prov. Colon, near sea-level, *Maxon 5740* (BM; W), *5750a* (BM; W), *5760* (W); El Valle de Anton, Prov. Coclé, in forest, 1,000 m., *Alston 8739* (BM); foothills of Garajará, Sambú basin, S. Darien, near sea-level, *Pittier 5595* (W); near Arenosa, lower Rio Trinidad, near sea-level, *Seibert 611* (W).

Geographical range: Panama southwards to Bolivia.

8. **Selaginella hoffmannii** Hieron. in Hedwigia xli: 184 (1902).—Donn. Smith, Enum. Pl. Guat. vii: 65 (1905).—Conzatti, Fl. Tax. Mex. i: 140 (1946).

Selaginella undulata Liebm. ex Fourn., Mex. Pl.: 148 (1872), *nom. nud.*
Selaginella weberi A. Braun ex Fourn., Mex. Pl.: 149 (1872), *nom. nud.*
Selaginella stellata sensu Fourn., Mex. Pl.: 148 (1872); non Spring.
Selaginella puberula sensu Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 708 (1886); non Kl.
Selaginella flabellata sensu Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 706 (1886) pro parte; non Spring.—Donn. Smith, Enum. Pl. Guat. i: 68 (1889).—Conzatti, Fl. Tax. Mex. i: 143 (1946).
Selaginella viticulosa sensu Donn. Smith, Enum. Pl. Guat. iv: 180 (1895), vi. 67 (1903); non Kl.

MEXICO. Vera Cruz: Misantla, *Purpus 5938* (BM; NY; W); Cordoba, *Bourgeau 1655* (K), *1655 bis* (K), *Carruthers* (BM), *Finck 87* (W), *Müller 2203* (NY); Cordoba, 825 m., *Seaton 397* (NY; W); Yeocatla, near Colipa, *Liebmann 2075* (H); Hacienda de Mirador, *Liebmann 2046* (H), *2050* (H); Mirador, *Purpus 16248* (W); Orizaba, on trees, *Mohr* (W); Tenampa, 900 m., Zacuapan, *J. Purpus 121* (W); *122* (W); *Purpus 5938* (BM), *6437* (BM; W). Colima: Alzado, *Orcutt 4640* (W). Guerrero: El Calabazal, near Zihuatenego, *Langlassé 454* (K; W); La Puerta, *Langlassé 421* (K); south of Chilpancingo, *Paxson, Webster & Barkley 17M792* (BM); base of cliff, Barranca de la Guacamaya, 490 m., *Mexia 8860* (BM). Oaxaca: Cueva de Teutila, 900 m., Distr. Cuicatlán, *Conzatti & Gómez 3520* (W). Chiapas: *Ghiesbreght 606* (BM); San Bartolo, *Rovirosa 869* (NY); Finca Irlanda, *Purpus 7220* (W), *7222* (W).

GUATEMALA. Between Finca San Rafael and Amelco, 400–500 m., *Steyermark 49565* (BM); Mazatenango, *Bernoulli 38* (NY), *Bernoulli & Cario 150* (K); Cubilquitz, Dept. Alta Verapaz, *Türckheim 8652* (K; W); Rio Frio, 1,200 m., *Johnston 739* (W), *755* (BM; W); Rio Cobán, 1,220 m., *Johnson 665* (W), *666* (BM; W), *667* (BM; W); Coban, Dept. Alta Verapaz, 1,300 m., *Türckheim 701* (W); Rio Xibanas, Finca San José Nil, Retalhuleu, on wet rock, *Hatch & Wilson 401* (BM).

SALVADOR. Ahuachapan, Dept. Ahuachapan, *Standley 19757* (NY; W); La Cebadilla, *Calderón 1204* (BM; NY).

HONDURAS. Rio Bermejo, Dept. Santa Barbara, *Thieme 5700* (NY; W); San Pedro Sula, 300 m., *Thieme 5700B* (W); Ceiba, *Dyer A. 159* (W); on rotten log, slopes of Mt. Congrejal, in deep forest, 305 m., *Yuncker, Koepper & Wagner 8783* (K); near San Francisco, Dept. Morazán, 850 m., *Williams & Molina 15916* (BM); along Rio Lindo, north of Lake Yojoa, Dept. Cortés, 500–600 m., *Morton 7844* (W).

NICARAGUA. Forest, Sierra west of Jinotega, Dept. Jinotega, 1,050–1,350 m., *Standley 10269* (T); Cerro de la Cruz, Dept. Jinotega, 1,200–1,400 m., *Standley 10983* (T).

Costa Rica. Near Aguacate, *Hoffmann 905, 905a, 909* (syn-types, ex. Hieron.); El Brasil, 900 m., *Valerio 21* (W).

Geographical range: eastern Mexico southwards to Costa Rica.

The affinity of the species seems to be with *S. radiata* (Aubl.) Spring from Guiana and *S. versicolor* Spring from W. Africa.

9. **Selaginella bombycina** Spring in Mém. Acad. R. Belg. xxiv: 191 (1850).

Costa Rica. Near Guápiles, Prov. Limon, 300–500 m., in wet forest, *Standley 37269* (W), *37086* (W); Carillo, 400 m., *Brade 840* (BD; frag. BM).

Panama. Hills above Campana, 600–800 m., *Allen 1885* (BM); forest, El Valle de Anton, Prov. Coclé, 1,000 m., *Alston 8773* (BM).

Geographical range: Ecuador and Peru.

Nearest to *S. sprucei* A. Braun (non Hook.), from which it is separated by its aristate median leaves, shorter and less branched habit, and less obtuse lateral leaves. From *S. speciosa* A. Braun it is separated by the closely ciliate lateral leaves.

10. **Selaginella anceps** Presl in Abh. Böhm. Ges. ser. 5, iii: 581 (1844).

Lycopodium gracile Desv. ex Poir. in Encycl. Méth., Bot. Suppl. iii: 551 (1814).
Lycopodium anceps Presl, Rel. Haenk. i: 80 (1825).
Selaginella flabellata sensu Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 706 (1886) pro parte; non Spring.—Donn. Smith, Enum. Pl. Guat. v: 102 (1899).—Christ in Pittier, Primit. Fl. Costaric. iii, 1: 61 (1901).—Hieron. in Engl., Bot. Jahrb. xxxiv: 579 (1905).
Selaginella oaxacana sensu Donn. Smith, Enum. Pl. Guat. iv: 180 (1895); non Spring.
Selaginella hartwegiana sensu Christ in Pittier, Primit. Fl. Costaric. iii, 1: 61 (1901); non Spring.
Selaginella pulcherrima sensu Christ in Pittier, tom. cit.: 62 (1901); non Liebm.
Selaginella gracilis (Desv.) Hieron. in Hedwigia lviii: 292 (1917); non Moore (1886).

Costa Rica. Rio Naranjo, 200–250 m., *Tonduz 7643* (W); Hacienda Parismina Banana Co., *Jimenez 1043* (W); La Palma, 1,500 m., *Valerio 5* (W); La Hondura, Prov. of S. José, 1,400 m., *Valerio 11* (W), *Standley 36120* (W); Siquerres, common along drainage ditches, *Stork 2265* (W); Buena Vista, road to San Carlos Valley, 600 m., *Cook & Doyle 120* (W); Rio Hondo, Llanos de S. Clara, 100 m., *Cook & Doyle 505* (W), *570* (W), *571* (W); Cerro Turubales, *Brade 478* (NY); Llanuras de San Carlos, *Brade 838* (NY); Juan Vinas, *Rowlee & Stork 817* (NY; W); Suerre, Llanuras de Santa Clara, 300 m., *Donnell Smith 6946* (K; NY; W); near Guapiles, Prov. Limon, 300–500 m., *Standley 37037* (W); La Colombiana Farm, Prov. Limon, 70 m., *Standley 36825* (W), *36841* (W); Jiménez, Llanos de Santa Clara, Comarca de Limón, *Donnell Smith 5105* (NY); Las Delicias, Santa Clara, 560 m., *Biolley 10662* (W); Port Limon, *Kuntze 2007* (NY); forests of Tsâki, Talamanca, 200 m., *Tonduz 9491* (W); near Angostura, *Polakowsky 446A* (BM); Pirris, *Biolley 49* (P), *17402* (W); near El General, Prov. San José, 575 m., *Skutch 2543* (W), *4061* (BM); San José, Prov. San José, 1,100 m., *Tonduz ed. J.D.S. 7316* (K; W); forests of Tuis, 650 m., *Tonduz 11343* (W).

Panama. *Cuming 1266* (BM), *Bridges* (K); Daytona Farm, Almirante, Prov. Bocas del Toro, *Cooper 140* (BM; NY; W); Rubber Tire Station, Western Panama, *Stork*

122 (W); Veraguas, *Bridges* (K); El Valle de Anton, 600 m., on steep shaded banks of Rio Anton, Prov. Coclé, *Allen 2767* (BM), 1,000 m., *Alston 8696* (BM); forests on dry limestone, near Alhajuela, Chagres Valley, Prov. Panama, 30–100 m., *Pittier 5718* (W).

Geographical range: Costa Rica southwards to Bolivia.

Mixed with *Standley 36825* is an apparently diseased form similar to the form described as *S. crassinervia* (Desv.) Spring, i.e. with small leaves and swollen midribs.

11. **Selaginella oaxacana** Spring in Mem. Acad. R. Belg. xxiv: 177 (1850).—F. W. Hall, Cat. Ferns Chiapas: 9 (1873).—Donn. Smith, Enum. Pl. Guat. i: 68 (1889).—Conzatti, Fl. Tax. Mex. i: 142 (1946).

Lycopodium flabellatum var. *strictum* Mart. & Gal. in Mém. Acad. R. Brux. xv: 12 (1842).

Selaginella guatemalensis sensu Donn. Smith, Enum. Pl. Guat. i: 68 (1889); non Bak.

Selaginella flabellata sensu Donn. Smith, Enum. Pl. Guat. ii: 92 (1891), vii: 65 (1905); non Spring.

Selaginella wendlandii Hieron. in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 683 (1901); in Hedwigia xli: 186 (1902).

? *Selaginella costaricensis* Hieron. locis cit.: 683 & 188.

Selaginella anceps sensu Christ in Pittier, Primit. Fl. Costaric. iii, 1: 61 (1901) pro parte; non A. Braun.

MEXICO. Oaxaca: Chinantla, *Galeotti 6608 bis* (photo BM; P), *6608* (Br.); Mt. Cuitcatlan, 1,000 m., *Gonzalez & Conzatti 734* (W); near Lacoba, Distr. Chinantla, *Liebmann 2051* (H). Chiapas: *Ghiesbreght 602* (BM; K); San Bartolo, *Rovirosa 868* (NY); S. Cristobal, *Munch 54* (P).

GUATEMALA. Near Esperanza, *Maxon & Hay* 3350 (NY); Santa Cruz Almor-Ixoan, Dept. Huehuetenango, *Bernoulli* (K); Pansamalá, Dept. Alta Verapaz, *Türckheim 653* (W), *679* (BM; NY; W), *Donnell Smith 1577* (K; W); Finca Mocca, 975 m., *Johnson 105* (NY; W); between Sepacuité and Secanquim, 1,000 m., *Pittier 316* (NY; W), 350 m., *Maxon & Hay 3118* (W); near Finca Sepacuite, *Cook & Griggs 62* (W), *89* (W); Quebradas Secas, 750 m., *Johnson 948* (BM; W); Río Cobán, 1,200 m., *Johnson 670* (BM; W); Finca Seamay, Senahu, Alta Vera Paz, 920 m., *Barton 35 pro parte* (BM); mountains above Trece Aguas, 920 m., *Cook & Doyle 7b* (W); Cubilqüitz, 350 m., *Türckheim 8485* (W); between Ixcan and Finca San Rafael, Sierra de los Cuchumatanes, 200–800 m., *Steyermark 49418* (BM), 1,200–2,000 m., *49157* (BM); Río Icvolai, near Finca Cubilqüitz, 300–350 m., *Steyermark 44745* (BM).

HONDURAS. Lancetilla Valley, near Tela, Dept. Atlántida, 20–600 m., *Standley 56791* (W); slopes of Mt. Cangrejal, 305 m., *Yuncker, Koepper & Wagner 8820* (St.).

COSTA RICA. *Wercklé* (BM); La Gloria de Juan Viñas, *Pittier 3661* (NY; W); Juan Viñas, *Brade 479* (NY); Las Vueltas-Turrique, *Tonduz* (K), *13349* (W, type-collection of *S. costaricensis*); Turrialba, *Maxon 153* (NY; W); San Miguel, *Wendland 771* (V, type-collection of *S. wendlandii*); Bonilla, *Ridgway* (W); Buena Vista, road to San Carlos Valley, 600 m., *Cook & Doyle 130* (W); La Hondura, Prov. S. José, 1,300–1,700 m., *Valerio 2* (W), *Standley 36200* (W), *36278* (W), *37776* (W), *37810* (W), *37876* (W); vicinity of La Palma, on the road to La Hondura, 1,500–1,700 m., *Maxon & Harvey 8001* (W); forests of La Palma, 1,459 m., *Tonduz 12584* (W), 1,500 m., *Valerio 13* (W), 1,600 m., *Standley 38142* (W), *38178* (W), *38217* (W), *Rowlee 217* (W), *Stork 447* (W); woods of Carara Puriscal, 400 m., *Jimenez 829* (W); Vara Blanca de Sarapiquí, between Poás and Barba, 1,250 m., *Skutch 3494* (St.), *3632* (St.); Pirrís, 20 m., *Biolley fil. 17401 pro parte* (W); vicinity of Pejivalle, Prov. Cartago, 900 m., *Standley 46868* (W), *46962* (W), *47006* (W); forests of Cabagra, *Tonduz 6551* (W); forests of Rio Ceibo at Buenos Aires, *Tonduz 4857* (W).

PANAMA. On ground in forest, El Valle de Anton, Prov. Coclé, 1,000 m., *Alston 8691* (BM).

Geographical range: Oaxaca southwards to Panama.

Similar plants (e.g. *Archer 1974*) have been found in Colombia, but require further study. The Costa Rican specimens usually have larger leaves, but I cannot find any character by which they can be separated specifically.

12. **Selaginella microdendron** Bak. in Journ. of Bot. xxiii: 116 (1885).

Selaginella sulcangula Spring in Mém. Acad. R. Belg. xxiv: 163 (1850) pro parte excl. planta Venezuelana; non Spring (1843).
Selaginella pulcherrima sensu Fourn., Mex. Pl.: 147 (1872) pro parte; non Liebm.
Selaginella harrisii Underw. ex Urban in Symb. Antill. vii: 162 (1912).
Selaginella millspaughii Hieron. in Hedwigia lviii: 285 (1917).
Selaginella enckei Nessel in Fedde, Repert. Sp. Nov. xlviii: 172 (1940).

MEXICO. Tamaulipas: Near Gómez Farias, 350 m., *Palmer 301* (NY). Vera Cruz: Potrero Viejo, 700 m., in tufts in shade on limestone ridges, *Copeland 171* (BM); banks of Rio Blanco, Orizaba, *Bourgeau 2540* (BM); Cordoba, *Finck 133 pro parte* (K). Yucatan: near Chichen Itzá, *Millspaugh 1620* (type-collection *S. millspaughii*, BM); in forest near Pisté, Chichen Itzá, *Steere 1365* (BM); under log-wood trees, near Cape Catoche, *Baqueiro* (ex Nessel, type of *S. enckei* Nessel).

BRITISH HONDURAS. Big Creek, edge of stream, *Schipp 99* (BM).

GUATEMALA. Finca Seamay, Senahu, Alta Vera Paz, 915 m., *Barton 29* (BM).

Geographical range: also in Cuba and Jamaica.

This species has been confused with *S. pallescens* (*cuspidata*), but may be separated by the ovate-triangular (not ovate-lanceolate) outline of the shoot-system, usually branching above (not below) the middle. The old dead leaves are light reddish-brown (not pale buff), the leaves dull green (not silvery) below, and the lateral leaves acuminate (not aristate).

S. pulcherrima Liebm. is similar in habit, but its median leaves have only a narrow white margin.

The Cuban plant is still very imperfectly known, and more material is desirable. Hieronymus attempts to separate *S. millspaughii* from the Jamaican plant (*S. harrisii*) by its very short 'rhizome' and consequently contracted branch-system, with lateral leaves somewhat less broad and with rather longer cilia in the lower part of both sides.

S. enckei I know from description only, but have little doubt that it represents this species.

13. **Selaginella pulcherrima** Liebm. ex Fourn., Mex. Pl. 147 (1872).—Bak. in Journ. of Bot. xxiii: 117 (1885).—Alston in Journ. of Bot. lxxi: 242 (1933).—Conzatti, Fl. Tax. Mex. i: 140 (1946).

Selaginella amoena Bull, Retail List Pl. no. 199: 16 (1884).—Dyer in Bull. Misc. Inf. Kew, Add. Ser. 4: 364 (1900).

MEXICO. Vera Cruz: wooded slopes near Hacienda de Jovo, *Liebmann 2061* (H, type; BM), s.n. (BM; K; W); Canton de Huatusco, 1,200 m., *Conzatti 807* (W).

Geographical range: confined to a small area in Vera Cruz, but widely cultivated in botanic gardens.

There is a specimen of *S. amoena* at Kew labelled by Thomas Moore 'Bull. Nov. 1881—Mexico 3244'.

I cannot find Fournier's reference to Liebmann (Udsigt over Lycopodiaceernes Forhold i Mexico, in Videnskabelige Meddelelser fra den Naturhistoriske Forening i Kjobenhavn, 1847), but his brief description 'Haec species tantum pro varietate altiori praecedentis verisimiliter habenda est, consentiente cl. Spring in litt.' appears to validate the name.

14. **Selaginella illecebrosa** Alston, sp. nov. (Plate 5).

Species heterophylla ex affinitate *S. flabellatae*; caulibus e basi breviter repente erectis, 23–50 cm. altis, 1·55–2·25 mm. in diam.; parte inferiore simplice 9–10 cm. longe, siccitate pallide straminea sulcata, foliis homomorphis subdistantibus tecta, rhizophoris basi restrictis; parte frondosa ambitu ovato-pentagona, tripinnata; ramis alternatis, internodis c. 1·5 cm. longis; foliis caulium ovato-ellipticis, basi ciliatis; foliis lateralibus partis frondosae leviter imbricatis, oblique oblongis, c. 5 mm. longis, 2 mm. latis, pagina superiore obscuriore; semi-facie superiore semi-lanceolata, basi rotundata ciliata parte superiore serrulata; semi-facie inferiore semi-oblonga, integra, basi ciliis nonullis intructo excepta; foliis axillaribus oblongo-lanceolatis basi ciliatis; foliis intermediis semi-orbicularo-reniformibus margine exteriore minute serrulata interiore integra, apice breviter aristata ex-auriculatis; strobilis ad marginem partis frondosis in apicibus ramulorum instructis tetragonis c. 5 mm. longis, 1 mm. latis; sporophyllis ovato-deltoideis carinatis serrulatis subacutis; megasporis circa 200 μ crassis, albido-griseis (in sicco), pallide flavis (humectis) triradiatis irregulariter sed crebre reticulato-rugosis; microsporis acervatim congregatis pallide miniatis, singulis pallide luteis, circa 25 μ crassis triradiatis in parte abaxiale papillis brevibus indutis.

MEXICO. Tabasco: Teapa, *Rovirosa 615* (W).

GUATEMALA. Rocky boulders along lower part of stream tributary to Rio Frio, Dept. Izabal, 75–150 m., *Steyermark 41579* (BM, type).

HONDURAS. Wet forest, common, near Tela, Lancetilla Valley, Dept. Atlántida, 20–600 m., *Standley 52940* (W), *53320* (W); Hacienda El Limon to El Paraiso, *Blake 7362* (W).

Geographical range: southern Mexico to Honduras.

15. **Selaginella californica** Spring in Mém. Acad. R. Belg. xxiv: 98 (1850).—Watson, Bot. Calif. ii: 350 (1880).—Hieron. in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 678 (1901).

'CALIFORNIA'. *Deppe* (P, dupl. of type).

Geographical range: known only from the type-collection.

Deppe's Californian travels were mainly in Lower California, where he visited Cape S. Lucas, La Paz, and Loreto. S. Watson thought that this species came from there, but it does not seem a likely habitat for this plant and it may have been from the State of Vera Cruz. Deppe went to Mexico in 1828 with Schiede and collected about Jalapa, Orizaba, Papantla, and Misantla.

Some plants labelled 'California, *Deppe*' in the Berlin Herbarium came from Hawaii, for example specimens of *Asplenium kaulfussii* Schlechtend. As I can find no character to distinguish *S. californica* from the Hawaiian *S. arbuscula* (Kaulf.) Spring, it seems possible that the specimen came from Hawaii.

16. **Selaginella mosorongensis** Hieron. in Hedwigia xliii: 4 (1904).

MEXICO. Vera Cruz: Motzorongo, between Tierra Blanca and Córdoba, *Schumann 1905* (P, type-collection; photo BM).

Geographical range: known only from the type-collection from Vera Cruz.

17. **Selaginella viticulosa** Klot. in Linnaea xviii: 524 (1844).

Selaginella menziesii sensu J. Sm. in Seem., Bot. Herald: 243 (1852–7); non Spring.

COSTA RICA. Río Naranjo, *Jimenez* (BM; W).

PANAMA. Santiago de Veraguas, growing on rocks, *Seemann 281* (BM); hills west of Soná, 500 m., Prov. Veraguas, *Allen 1047* (BM).

Geographical range: Venezuela. Also as an escape in Brazil, Trinidad and Bermuda.

18. **Selaginella schaffneri** Hieron. in Engl. & Prantl, Pflanzenfam. i, 4: 674 (1901); in Hedwigia xli: 172 (1902).—Davis, Life of Pringle: 332, 508 (1938).

Selaginella saccharata sensu Eaton in Proc. Amer. Acad. Art. Sci. xviii: 189 (1883).—Davis, Life of Pringle: 71, 652 (1936); non. A. Braun.

MEXICO. San Luis Potosi: San Rafael Mts., *Schaffner 8* (type-collection, BM, NY); *Schaffner 936* (NY). Jalisco: Bluffs of the barranca near Guadalajara, cool ledges and banks, *Pringle 2594* (BM; W); near Guadalajara, face of cliffs, *Pringle 2040* (BM; NY), *15630* (W). Mexico: Bejucos, district of Temascaltepec, *Hinton 7391* (BM; W).

Geographical range: restricted to the Central Mexican Plateau.

The uniform leaves of the prostrate main stem are an unusual character, but are not always clearly visible when only the tops of lateral branches are collected. The rhizophores are sometimes conspicuous and regularly dichotomous.

19. **Selaginella lindenii** Spring in Bull. Acad. Brux. x: 142 (1843).—Fourn., Mex. Pl.: 148 (1872).—Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 707 (1886).—Conzatti, Fl. Tax. Mex. i: 143 (1946).

MEXICO. Tabasco: Teapa, on wet shady rocks, *Linden* (P, type; BM); *1599* (K).

Geographical range: known only from a single locality in Tabasco.

This is, with the exception of *S. porphyrospora* A. Braun and *S. revoluta* Bak., the only species from continental North America with hairs on the upper surface of the leaves, as in the Jamaican *S. hispida* (Willd.) A. Braun ex Urb. (*S. swartzii* Spring), which has, however, ovate (not oblong) leaves. *S. delicatissima* Linden is the Mexican species which comes nearest to *S. lindenii*.

20. **Selaginella delicatissima** Linden [Catalogue no. 11: 20 (1856) *nom. nud.*] A. Braun in Index Sem. Hort. Bot. Berol. 1857, App.: 13 (1858?); op. cit.: 24 (1860); Ann.

Sci. Nat. sér. 4, xiii: 60 (1860).—Hieron. in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 689 (1901).

Selaginella saccharata A. Braun in Ann. Sc. Nat. sér. 5, iii: 272 (1865).—Triana & Planch., Prodr. Fl. Novo-Granat.: 356 (1867).—Conzatti, Fl. Tax. Mex. i: 142 (1946).
Selaginella sanguinolenta Liebm. ex Fourn., Mex. Pl. 148 (1872), in syn.; non (L.) Spring.
Selaginella purpuripes Liebm. ex Fourn., loc. cit.
Selaginella spirillum Liebm. ex Fourn. loc. cit.—Davis, Life of Pringle: 81 (1936).
Selaginella feeana Spring ex Fée, Mém. Fam. Foug. ix: 36 (1857), *nom. nud.*
Selaginella saccharata vars. *major* and *minor* Fourn., Mex. Pl.: 148 (1872).
Selaginella serpens sensu Sch. Bip. ex A. Braun, loc. cit., in syn.; non (Desv.) Spring.

MEXICO. Nuevo Leon: Sierra Madre, near Monterey, *Pringle 1978* (BM; NY; W); sandstone cliff, 'Alamar', Pablillo, SE. of Galeana, 1,650–1,700 m., *Pennell 17199* (W); Cerro del Viejo, 24 km. west of Dulces Nombres, Municipality of Zaragoza, *Meyer & Rogers 3049* (BM). Tamaulipas: Cerro Zamora, Sierra de San Carlos, near Milagro, *Bartlett 11046* (BM; W). San Luis Potosi: *Schaffner 9* (BM; NY; W); Tamasopo Cañon, *Pringle 3296* (BM; NY; W); near Los Canos, *Palmer 266* (NY; W); San Miguel Mts., *Schaffner* (NY). Jalisco: Near Guadalajara, *Pringle 2634* (NY). Hidalgo: Barranca below Honey Station, *Pringle 15620½* (W); Atotonilco, *Berlandier 405* (BM). Vera Cruz: Zacuapan, *Purpus 2388* (BM; NY; W), *2849* (BM), *6438* (BM; NY; W), *8924* (BM), *14034* (W), *14019* (BM); *J. Purpus 116* (W); Huatusco, 1,200 m., *Conzatti 808* (W); Sierra de S. Cristobal, *Sartorius* (syn-type of *S. saccharata* A. Braun, fragm. W); Dos Puentes, between Totilla and Huatusco, *Liebmann* (W); Orizaba, *Bilimek 484* (BM; K; NY; W), *Müller 367* (NY), *737* (K; NY), *Mohr* (W), *Mohr & Botteri* (W); Upper Barranca de Tenampa, 900 m., *J. Purpus 115* (W), *117* (W), *119* (W), *464* (NY; W); Cordoba, *Hahn 1426 bis* (K); rocks in half-shaded places, Fortin, 800–900 m., *J. Purpus 118* (W); Barranca de Panoya, *Purpus 8464* (W). Colima: San Marcos, *Jones 486* (W). Michoacan: Campanario, near Morelia, 2,100 m., *Arsène 5614* (W), *10678* (W); Cerro Azul, near Morelia, *Arsène 6025* (BM; W), *ed. Ros. 30* (W); Punguato, near Morelia, 1,950 m., *Arsène 5819* (W); near la Huerta, Morelia, 1,950 m., *Arsène 5980* (BM; W); Cerro San Miguel, 2,200 m., *Arsène 5561* (W), *5624* (W); Rincon, near Morelia, 1,900 m., *Arsène 2663* (W); Jaripeo, 2,100 m., near Morelia, *Arsène 5989* (W), *6022* (W); S. Maria, near Morelia, *Arsène* (BM). Morelos: Sierra de Tepoxlan, *Rose & Painter 7250 pro parte* (W); near El Parque, *Rose & Painter 7250A* (BM). Guerrero: 16 km. north of Chilpancingo, *Frye 2578* (BM). Oaxaca: Chinantla, *Sallé* (BM); dry rocks near Chinantla, 2,150 m., *Liebmann 2065* (H).

GUATEMALA. Under bushes, Santa Rosa, 1,600 m., Baja Verapaz, *Türckheim II. 2180* (W).

Geographical range: confined to Mexico and Guatemala.

Selaginella delicatissima Linden was described by A. Braun from specimens in the Berlin Botanic Garden which had been received from Linden in 1856. Williams (Select Ferns: 223 (1868)) gives its origin as Colombia, but there seems to be no justification for this statement. Hieronymus says 'vermutlich aus den Anden Nordamerikas'. It rarely fruits in cultivation, and I have seen no cultivated specimens with fruit; but Hieronymus describes the spores. The dead leaves sometimes take on a reddish tinge, which is characteristic of the species and unusual in the genus.

A. Braun's epithet *saccharata* was given on account of the resemblance of the microspores to ground yellow sugar.

21. **Selaginella douglasii** (Hook. & Grev.) Spring in Bull. Acad. Brux. x: 138 (1843); in Mém. Acad. R. Belg. xxiv: 92 (1850).—Piper in Contr. U.S. Nat. Herb. xi: 87 (1906).—A. Tryon in Ann. Miss. Bot. Gard. xxxvi: 422, 36, fig. 28 (1949).

Lycopodium ovalifolium Hook & Grev., Ic. Fil.: t. 177 (1829); non Desv.
Lycopodium douglasii Hook. & Grev. in Hook. Bot. Misc. ii: 396 (1831); Hooker, Fl. Bor. Amer. ii: 268 (1840).
? *Lycopodium denticulatum* sensu Wilks, Journ. D. Douglas: 145 (1914); non L.

UNITED STATES. Idaho: Rocky cliffs near Deadman Creek, on the Lochsa R., 765 m., *Young* (BM); moist slopes about Selway Falls, Idaho Co., *Aase 1774* (BM). Washington: Cape Horn, *Howell 35* (ex Piper), *Piper 4965* (ex Piper); Kalama, *Hemphill* (K). Oregon: Columbia R., near spring in wood, *Douglas* (K); abundant in moist places on the hills near Grand Rapids, Columbia R., above Vancouver, Sept. 1825, *Douglas 482* (ex Wilks); banks of the Columbia, *Lobb* (BM); Portland, *Godman 342* (BM); damp, shady rocks, near Bonneville, *Suksdorf* (BM).

Geographical range: western North America.

Hooker gives the type-locality as 'Northwest cost of America, Douglas', but Spring 'in sylvestribus Columbiae, frequens'. I have extracted information which presumably relates to the type-locality from Douglas's Journal. Northern California and British Columbia are included in the range of this species in most American books, but I have seen no specimens quoted. The locality 'British Columbia' appears in Baker (Handb. Fern-Allies: 48 (1887)) and it seems to have arisen through confusion with the Columbia River. Hooker wrote 'Columbia, Douglas' on the Kew sheet and Baker has added 'British'. Mr. G. A. Hardy could find no specimen in the herbarium of the Provincial Museum at Victoria, B.C., nor any reference to the species in local lists.

I have ascertained by correspondence that there are no specimens from Northern California in the herbaria at the University of California, Dudley Herbarium, Stanford, or U.S. National Herbarium. The suggestion that this species was to be found there seems to have started with S. Watson (Bot. Calif. ii: 350 (1880)) who stated that it was probably in Northern California. In 'The Fern Allies': 160 (1905), Clute wrote 'it is reported to grow in Northern California, Oregon, Washington, and British Columbia', and later authors, starting with Piper (Contrib. U.S. Nat. Herb. xi: 87 (1906)), made the statement positive.

22. **Selaginella ludoviciana** A. Braun in Index Sem. Hort. Bot. Berol. 1857, App.: 12 (1858?); 1859, App.: 21 (1860); 1867: 2 (1868).—Correll in Amer. Fern Journ. xxviii: 98 (1938).—M. Broun, Index to N. American Ferns: 157 (1938).

Selaginella apus var. *denticulata* Spring in Mém. Acad. R. Belg. xxiv: 77 (1850).
Lycopodium louisianum Link ex Courtin, Cult. Farn.: 88 (1855).
? *Selaginella albidula* var. *macrostachya* (A. Braun) Hieron. in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 695 (1901).
? *Selaginella apus* var. *macrostachya* A. Braun ex Hieron., op. cit., in syn.
Diplostachyum ludovicianum (A. Braun) Small, Ferns S.E. United States: 422 (1938).

United States. Florida: Without locality, *Rugel* (W), *O'Neil 82* (W), *Bartram* (BM); Chattahoocha, *Chapman* (W); Apalachicola R., Aspalaga, *Correll & Kurz 5675* (W); on dry rocks, Aspalaga, *Wherry* (W); Gainesville, *Piper* (W); Chattahoochee R., common at spring, *Bush 233* (W). Louisiana: Pine woods, Mandeville, *Langlois* (W); Covington, *Drummond* (K); Sulphur Spring, Covington, *Arsène 11648* (W). Alabama: 1832, *Drummond* (K). Texas: (ex Broun).

Geographical range: confined to Alabama, Florida, Louisiana and Texas.

This is a more straggling plant than *S. apoda*, blue-green, with the leaves narrower and of thicker texture. Brown & Correll reduce *S. ludoviciana* to *S. apoda* in their 'Ferns & Fern Allies of Louisiana': 157 (1942).

23. **Selaginella apoda** (L.) Morren, Belg. Hort. iv: 70 (1854).—Fernald in Rhodora xvii: 68 (1915).

Lycopodium apodum L., Sp. Pl.: 1105 (1753).
Diplostachyum apodum (L.) Beauv., Prodr.: 107 (1805).
Lycopodium albidulum Sw., Syn. Fil.: 183, 409 (1806).
Selaginella albidula (Sw.) Spring in Flora xxi: 214 (1838).
Selaginella apus Spring in Mart., Fl. Bras. i, 2: 119 (1840) pro parte.
Lycopodioides apodum (L.) O. Kuntze, Rev. Gen. i: 824 (1891).
Selaginella sp.—Davis, Life Pringle: 222, 244, 332, 591, 619 (1936).

Mexico. Hidalgo: Canales, *Pringle 8797* (W). Puebla: Honey Station, wet banks, *Pringle 8797* (NY); banks of brooks, near Honey Station, *Pringle 10815* (W). Chiapas: S. Cristoval, *Munch 37* (BM; P).

Geographical range: Canada and eastern United States from Maine to British Columbia southwards to Florida, Louisiana and Texas.

The British Museum has specimens from Ontario, Wisconsin, Connecticut, Virginia, Georgia, Pennsylvania, Florida, Louisiana, N. and S. Carolina, New York, Delaware, Ohio and Illinois. In addition, I have seen specimens in the U.S. National Herbarium from Tennessee, Alabama, Texas, W. Virginia, and Kentucky.

Some specimens from Mexico greatly resemble this species, and are best placed here.

I have not considered the transfer *Selaginella apoda* (L.) Linden (Cat. no. 8: 15 (1853)) as validly made. Morren's is an implied combination with some description: if not accepted as a valid transfer it might be held to invalidate Fernald's combination as a later homonym.

24. **Selaginella tarapotensis** Bak. in Journ. of Bot. xxi: 98 (1883).

Selaginella faucium Liebm. ex Fourn., Mex. Pl.: 148 (1872) *nom. nud.*—Bak. in Journ of Bot. xxi: 333 (1883); Handb. Fern-Allies: 58 (1887).—Alston in Journ of Bot. lxxi: 243 (1933).—Conzatti, Fl. Tax. Mex. i: 143 (1946).

Mexico. Vera Cruz: Hacienda de Jovo, *Liebmann* (K), *2048* (H); Huitamalco, *Liebmann* (K), *2047* (H); near Consoquitla on rocks, *Liebmann 2049* (H). Oaxaca: clay banks in dense forest, Santa Maria, *Mexia 9270a* (BM).

Guatemala. Near Finca Sepacuite, Alta Verapaz, *Cook & Griggs 55* pro parte (W), *64* (W).

Panama. Near Cana, 920 m. *Williams 894* (BM; NY).

Geographical range: southwards to Bolivia (*Buchtien 1071*).

This species seems doubtfully distinct from the Brazilian *S. flexuosa* Spring.

25. **Selaginella ovifolia** Bak. in Journ. of Bot. xxii: 90 (1884).

British Honduras. Shady creek bank, Big Creek, 30 m. *Schipp 924* (BM; BD); Mountain Pine Ridge, El Cayo District, *Bartlett 11761* (BM), *11921* (BM).

Geographical range: Cuba, Hispaniola, Jamaica, Puerto Rico.

26. **Selaginella reflexa** Underw. in Bull. Torr. Bot. Club xxi: 268 (1894).—Davis, Life Pringle: 68, 237, 332, 508, 612 (1936).—Conzatti, Fl. Tax. Mex. i: 142 (1946).

Selaginella microphylla sensu Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 708 (1886); non Spring.

Selaginella carioi Hieron. in Engl. & Prantl Nat. Pflanzenfam. i, 4: 688 (1901); in Hedwigia xli: 198 (1902).

Selaginella microphylla var. *albomarginata* A. Braun ex Hieron. in Hedwigia xli: 200 (1902) in syn.

Selaginella schiedeana sensu Davis, Life Pringle: 81, 332, 516 (1936); non A. Braun.

Mexico. San Luis Potosi: Tamasopo Canyon, *Pringle 3292* (BM; NY; W); Minas de San Rafael, *Purpus 5488* (BM; NY; W). Jalisco: Near Guadalajara, on damp rocks and banks, *Pringle 2635* (BM; NY; W); Barranca de Oblatos, 1,220 m., *Barnes & Land 209* (BM). Guerrero: Iguala Canyon, 920 m., *Pringle 10326* (BM; NY; W); Cañon de la Mano Negra, near Iguala, *Rose, Painter & Rose 9391* (W).

Guatemala. Left bank of R. Motagua, between Barbasco and Gualan, *Bernoulli 955* (BM; K; NY; P); banks of R. Chixoy, Alta Verapaz, *Bernoulli & Cario 172* (P); on bare vertical face of limestone bluff, Cerro Chinajá, above source of Rio San Diego, 150–170 m., *Steyermark 45657* (BM); around Salamá, Baja Verapaz, *Cook 271* (BM).

Geographical range: Mexico and Guatemala.

27. **Selaginella guatemalensis** Bak. in Journ. of Bot. xxi: 243 (1883) pro parte—Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: t. 109 (1886).—Donn. Smith, Enum. Pl. Guat. i: 68 (1889) pro parte, ii: 92 (1891), vi: 76 (1903).

Selaginella lehmanni Hieron. in Hedwigia xliii: 33 (1904).

Selaginella pansamalensis Hieron., tom. cit.: 35 (1904).

Mexico. Oaxaca: Between Lobani and Petlapa, Distr. Chinantla, *Liebmann 2060* (H).

British Honduras. Capan R., 795 m., *Schipp 8–818* (BM).

Guatemala. Near Puxala, Baja Vera Paz, 1,700 m., *Lehmann 1329* (type-no. of *S. lehmannii* Hieron., BM); Senahu, *Maxon & Hay 3297* (NY); Finca Seamay, Senahu, 920 m., *Barton* (BM); Coban, Alta Vera Paz, *Salvin & Godman* (K, type); Pansamala, 1,160 m., among rocks, *Türckheim 653* (P; NY, type-collection of *S. pansamalensis*); between Peten and Samac, near Cobán, 1,400 m., on wet ground, *Türckheim 79* (K; P); near Copan, *Türckheim* (W); Cubilquitz, 350 m., *Türckheim 8360* (W), *8361* (BM; NY; W), *8362* (W), *8363* (W); near summit of Cerro Sillab, Senahu, Alta Verapaz, *Hatch & Wilson 167* (W); Samac, 1350 m., *Johnson 822* (BM); between Chamá and Cobán, 900 m., *Johnson 824* (BM), 610 m., *Johnson 945* (BM); Quebradas Secas, 765 m., *Johnson 947* (BM); trail between Sepacuité and Secanquin, 550 m., *Maxon & Hay 3116* (BM; W); Cerro Huitz, Sierra de los Cuchumatanes, Dept. Huehuetenango, 1500–2600 m., *Steyermark 48671* (BM); Finca Mocca, Alta Verapaz, 1,000 m., *Johnson 150* (BM); between Finca Chimoté and Finca Cubilguitz, 300–350 m., *Steyermark 44455* (BM); Cerro Chinajá, between Finca Yalpemech and Chinajá, 150–700 m., *Steyermark 45683* (BM).

HONDURAS. Near Siguatepeque, Dept. Comayagua, *Standley 56191* (BM: W); Barranco de Trincheras, near Siguatepeque, Dept. Comayagua, in rain-forest, 4,200 m., *Morton 7577* (BM); on rocks in spray of water-fall, ravine near El Achote, in hills above the plains of Siguatepeque, 1,350 m., *Yuncker, Dawson & Youse 5840* (BM); near El Achote, 1,350 m., *Yuncker, Dawson & Youse 6214* (BM), 1,700 m., *6436* (BM).

Geographical range: southern Mexico southwards to Honduras.

Baker's specimen from Nicaragua was *S. huehuetenangensis* Hieron.

28. **Selaginella huehuetenangensis** Hieron. in Hedwigia xliii: 32 (1904).

Selaginella guatemalensis Bak. in Journ. of Bot. xxi: 243 (1883) pro parte.

BRITISH HONDURAS. *Peck 634* (BM; W); El Cayo District, San Antonio, *Bartlett 13032* (BM); near Camp 6, El Cayo District, *Gentle 2362* (BM); Little Mountain Pine Ridge, *Bartlett 11881* (BM); Copan R., 800 m., Forest Home, Punta Goida, 61 m., *Schipp 8–820* (BM; BD.)

GUATEMALA. Gualan, *Bernoulli & Cario 162* (K); Choctum, *Salvin & Godman* (K); Culpan, near Colomba, *Rodriguez 289* (P); near Quiriguá, Dept. Izabal, *Standley 23690* (NY; W), *23908* (NY; W), *24173* (NY; W), *24707* (NY; W); Los Amates, *Kellerman 7412* (BM; NY), *Blake 7719* (W); Cerro de las Minas, Los Amates to Izabal, *Blake 7788* (W), *7796* (W); vicinity of La Libertad, Dept. Petén, *Aguilar 490* (BM); Monté Santa Teresa, Distr. Petén, *Lundell 2661* (W), *3883* (W); Carillo, *Cooper 569* (BD); vicinity of Secanquim, about 550 m., Dept. Alta Verapaz, *Maxon & Hay 3123* (BM; W); Finca Seamay, Senahu, 920 m., *Barton* (BM); near Finca Sepacuite, *Cook & Griggs 358* (W); Secanquim, *Cook & Griggs 271* (W); trail from Panzás to Sepacuité, *Maxon & Hay 3105* (W); near Secanquim, trail to Cahabon, *Goll 31* (W); between Chama and Cobán, 610 m., *Johnson 943* (BM; W), *944* (W); between Ixcan and Finca San Rafael, Sierra de los Cuchumatanes, Dept. Huehuetenango, 200–800 m., *Steyermark 49406* (BM), *49408* (BM); along Rio Santa Isabel, between mouth of Rio Sebol and El Porvenir, Petén, 100 m., *Steyermark 45839* (BM); along Rio Frío and tributaries, 75–150 m., Dept. Izabal, *Steyermark 39979* (BM); Savanna north of Concepción, Alta Verapaz, 100–110 m., *Steyermark 45273* (BM); crevices of rock, SW. of Lanquín, 600–1,000 m., *Steyermark 44102* (BM); between Finca Cubilguitz and Hacienda Yaxacabanal, 300 m., Alta Verapaz, *Steyermark 44826* (BM).

HONDURAS. Near Siguatepeque, Dept. Comayagua, 1,080–1,400 m., *Standley 55920* (BM; W), 1,050 m., *Yuncker, Dawson & Youse 5707* (BM; W); Ceiba, 152 m., *Dyer A. 175* (W).

NICARAGUA. Chontales, *Tate* (K); dense wet forest, near La Libertad, 5–700 m., *Standley 8806* (T), *9061* (T); Ballange Hills, Bahia de Bluefields, Dept. Zelaya, 0–30 m., *Molina 1847* (T); on wet rocks in forest, Aberdeen Hills and El Paal, Bahia de Bluefields, Dept. Zelaya, 0–30 m., *Molina 2025* (T); near El Recreo, on Río Mico 30 m., *Standley 19184* (T), *19217* (T), *19400* (T), *20060* (T), *20144* (T.)

COSTA RICA. Llanuros de San Carlos, 500 m., *Brade 476* (BD), *477* (BD; NY); Cuesta de la Vieja, road to San Carlos, 300 m., *Cook & Doyle 112* (W).

PANAMA. Forests around Porto Bello, Prov. Colon, 5–200 m., *Maxon 5753* (BM).

Geographical range: British Honduras to Panama.

29. **Selaginella idiospora** Alston sp. nov. (Plate 6.)

Species heterophylla ex affinitate *S. guatemalensi*, caulibus prostratis repentibus c. 40 cm. longis, usque ad 1 mm. in diametro, in sicco pallide stramineis, glabris, ubique ramosis, ramulorum systema oblongo-linearis bipinnata gerentibus leviter angulatis; rhizophoris passim regulariter dispositis ventralibus rectis 0·5 mm. diametris; ramis alternatis circiter 1 cm. longis; foliis lateralibus caulium crebre dispositis, pagina superiore valde obscuriore, inaequilateralibus; semi-facie superiore semi-oblongo-ovato basi conspicue cordata supra caulem imbricato margine longe cilato, cellulis marginalibus elongatis perpaucis; semi-facie inferiore semi-oblongo, basi truncate integro apicem versus cuneato minute serrulato; foliis axillaribus ovato-oblongis, ciliatis; foliis intermediis suborbicularibus ciliatis, aristatis, aristis circa tertiam partem folium aequantibus; strobilis in apicibus ramulorum solitariis, tetragonis; sporophyllis ovato-deltoideis ciliolatis vel denticulatis carinatis leviter acuminatis; megasporis non visis; microsporis acervatim congregatis miniatis circa 22 μ crassis, triradiatis, in parte abaxiale muris circa 3 μ altis irregulariter anastomosantibus.

GUATEMALA. Forest along Saklak R., 300 m., below Secanquim, Alta Verapaz, *Pittier 191* (BM, type); vicinity of Secanquim, *c.* 350 m., *Maxon & Hay 3225* (BM); Finca Seamay, near Senahu, Alta Verapaz, 920 m., *Barton* (BM); Jocolo, Dept. Izabal, 30 m., *Johnson 1124* (BM).

HONDURAS. On moist rocky cliff along the Danto River, slopes of Mt. Cangrejal, 335 m., *Yuncker, Koepper & Wagner 8728* (St.).

30. **Selaginella revoluta** Bak. in Journ. of Bot. xxi: 141 (1883).—Alston in Fedde, Repert. Sp. Nov. xlv: 315 (1936).

Selaginella demissa Christ in Bull. Herb. Boiss. sér. 2, i: 75 (1901).

PANAMA. Near El Valle de Anton, Dept. Coclé, on ground in forest, 1,000 m., *Alston 8778* (BM).

Geographical range: Panama to Guiana (*Tutin 544*), northern Brazil and Peru.

31. **Selaginella armata** Bak. in Journ. of Bot. xxii: 90 (1884).

Selaginella rhodospora Bak., tom. cit.: 111 (1884).

Selaginella eatoni Hieron. ex Small, Ferns Trop. Florida: 67, t. 49 (1918).—Britt. & Millsp., Bahama Fl.: 477 (1930).—Correll in Amer. Fern. Journ. xxviii: 98 (1938).

UNITED STATES. Florida: Stuart, *Richardson* (BM); about lime sinks, border of everglade, Black Point Creek, *Eaton 265* (W); in hammocks, Black Point, below Cutler, *Small & Carter* (W), *1147* (W); hammocks Long Key, *Small & Carter 3224* (W).

Geographical range: southern Florida to Puerto Rico.

32. **Selaginella schiedeana** A. Braun in Index Sem. Hort. Berol. 1857, App.: 14 (1858?); in Ann. Sci. Nat. sér. 4, xiii: 62 (1860).—Conzatti, Fl. Tax. Mex. i: 143 (1946).

Lycopodium serpens sensu Cham. & Schlecht. in Linnaea v: 622 (1830); non Desv.
Selaginella liebmanni Fourn., Mex. Pl: 148 (1872), *nom. nud.*
Selaginella fimbriata Liebm. ex Fourn., loc. cit., in syn.
Selaginella lychnuchus var. *rigidiuscula* sensu Fourn., loc. cit.; non Spring.

MEXICO. San Luis Potosi: Tamazunchale, 400 m., on damp bank, *Copeland 167* (BM). Vera Cruz: Papantla, *Schiede* (BM); near Papantla, *Liebmann 2068* (H); Zacuapan, *Purpus 2938* (BM; W), *7439* (BM; W); above Fortin, *Barnes & Land 669* (BM); Songsong R. gorge, 950 m., on limestone in partial shade, *Copeland 166* (BM); near Santa Maria Tlapacoyo, *Liebmann 2069* (H); near Colipa, *Liebmann 2070* (H).

Geographical range: confined to the states of San Luis Potosi and Vera Cruz in eastern Mexico.

33. **Selaginella stenophylla** A. Braun in Index Sem. Hort. Berol. 1857, App.: 22 (1858); in Ann. Sci. Nat. sér. 4, xiii: 83 (1860), sér. 5, iii: 291 (1865).—Conzatti, Fl. Tax. Mex. i: 142 (1946).

Selaginella macroura Liebm. ex Fourn., Mex. pl.: 148 (1872), in syn.
Selaginella lychnuchus sensu Fourn., loc. cit.; non Spring.
Selaginella incurvata Bak. in Journ. of Bot. xxi: 99 (1883).
Selaginella vaginata sensu Liebm. ex Bak., loc. cit. in syn.; non Spring.
Selaginella miradorensis Hieron. in Hedwigia xliii: 30 (1904); in Verh. Bot. Ver. Brandenb. li: 10 (1910).
Selaginella martensii sensu Davis, Life Pringle: 81, 332, 516 (1936) pro parte; non Spring.

MEXICO. San Luis Potosi: Tamasopo Canyon, *Pringle 3293* (BM; NY; W), 4–500 m., *Pennell 17995* (W); near Los Canos, *Palmer 265* (BM; NY; W); Tamazunchale, 300 m., *Copeland 165* (BM), 400 m., *Copeland 'L'* (BM); near Cancanhuitz, *Seler 206* (ex Hieron.); Ciudad del Maiz, Valle del Rio Naranjos, *Seler 749* (ex Hieron.). Hidalgo: Santa Ana, 40 km. north of Tacala, *Frye 2546* (BM). Vera Cruz: Fortin, on clay banks, *Barnes & Land 632* (BM; K); Orizaba, *Botteri 79* (BM), *Mohr 1300* (W), *Fisher 59* (W); La Luz, near Cordoba, *Kerber 62* (BM); Zacuapan, moist rocks, *Purpus 2389* (BM; NY; W), *6193* (BM), *J. Purpus 127* (W), *Liebmann* (H); Misantla, *Purpus 5937* (BM; NY; W); Mirador, *Schaffner 6* (K), *Liebmann 2071* (H), 1,000 m., in woods, *J. Purpus 128* (W); Valley of Cordoba, *Bourgeau 1654* (K; W), *1655* pro parte (K); Córdoba, *Spence* (W); Chiquihuite, *Hahn 2156* (K); Hacienda de Santa Barbara, *Liebmann* (K); Metlac R., 900 m., *Copeland 165a* (BM); Songsong R. gorge, 900 m., on limestone, *Copeland 'N'* (BM).

GUATEMALA. Rio Frio, Dept. Alta Verapaz. 1,200 m., *Johnson 746* (BM; W); near Coban, 1,500 m., *Türckheim II. 2114* (W).

Geographical range: confined to Mexico and Guatemala.

34. **Selaginella lychnuchus** Spring ex Klot. in Linnaea xx: 435 (1847) *nom. nud.*; in Mém. Acad. R. Belg. xxiv: 247 (1850).

COSTA RICA. Wet bank, La Hondura, Prov. San José 1,300–1,700 m., *Standley 36193* (W), *36279* (W).

Geographical range: also in Venezuela.

35. **Selaginella martensii** Spring in Mém. Acad. R. Belg. xxiv: 129 (1850).—Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 707 (1886).—Conzatti, Fl. Tax. Mex. i: 142 (1886).

? *Lycopodium brasiliense* sensu Desf., Cat. Pl. H. R. Par. ed 3: 417 (1832).
? *Lycopodium stoloniferum* sensu Link, Hort. R. Bot. Berlin ii: 162 (1833).—Lindl. in Don, Hort. Cantab. ed. 13: 683 (1845); non Sw.
? *Selaginella decomposita* Spring in Mart., Fl. Bras. i, 2: 123 (1841) pro parte quoad pl. cult.
Lycopodium flabellatum sensu Mart. & Gal. in Mém. Acad. R. Belg. xv: 11 (1842); non L.
Selaginella solmsii Bak., Handb. Fern-Allies: 56 (1887).

MEXICO. San Luis Potosi: South Tamasunchali, *Clarke 6880* (NY). Vera Cruz: Orizaba, *Botteri 80* (BM), *Mohr* (W); Jalapa, *Orcutt 2807* (BM; W); near Jalapa, *Rose & Hay 6140* (W); Córdoba, *Schaffner 7* (NY), *Bourgeau 2275* (K); Zacuapan, *Purpus 2177* pro parte (W), *6439* pro parte (BM); Huatusco, *Sandoval 18* (W). Oaxaca: Cuicatlan district, *Conzatti 3821* (NY); Cueva de Feutila, 900 m., near Cuicatlan, *Conzatti & Gomez 3529* (W); near Plunia, 920–1,465 m., *Nelson 2472* (W). Chiapas: Finca Irlanda, *Purpus 7220* (BM; NY; W); Seltepec, *Matuda 226* (K; W).

GUATEMALA. Finca Seamay, Senahu, Alta Vera Paz, 920 m., *Barton 33* (BM); road between Verapaz and Chixoy, 1,200–1,300 m., *Steyermark 43917* (BM); Volcán Santa Clara, near Finca El Naranjo, 1,250–2,650 m., *Steyermark 46672* (BM); near Palohueco, Costa Grande, *Bernoulli & Cario 181* (K, type of *S. solmsii* Bak.); near Patio de Bolas, above San Felipe, *Maxon & Hay 3552* (W); mountain above Trece Aguas, Alta Verapaz, 855 m., *Cook & Doyle 7d* (W); Quebradas Secas, 450 m., Dept. Alta Verapaz, *Johnson 946* (BM); Río Frio, 1,200 m., Alta Verapaz, *Johnson 741* (BM), *742* (BM), *743* (BM); Pansamalá, Alta Verapaz, 1,160 m., *Donnell Smith 1576* (W); Finca Helvetia, Dept. Quelzaltenango, 1,525 m., *Muenscher 12174* (W); Volcan Santa Maria, near Patzulin, *Muenscher 12175* (W).

COSTA RICA. Finca Navarro, 1,350 m., *Maxon 626* (NY; W); El Muñeco, south of Navarro, Prov. Cartago, 1,400 m., *Standley 33445* (W); Orosi, Prov. Cartago, *Standley 39614* (W), *39866* (W).

PANAMA. Chiriqui, humid forest between Alto de las Palmas and top of Cerro de la Horqueta, 2,100–2,268 m., *Maxon 5523* (BM).

Geographical range: Mexico to Panama.

One of the best known species in cultivation in European botanic gardens. Lindley gives the date of introduction into Britain as 1831. A number of horticultural forms have been given varietal names. *S. martensii* is a 'short-day' plant and Laibach has shown (F.I.A.T. Report No. 1093) that when there is a day cycle cone formation takes place earlier and cones are more numerous when exposed to a short-day (8 hours) cycle than with a long day (16 hours). Cone production is inhibited in sporeling cultures by high atmospheric humidity. Bright light intensity favours cone production.

forma **albovariegata** (Bull) Alston comb. nov.

S. martensii var. *albo-variegata* Bull in Proc. Hort. Soc. v: 194 (1865).
S. martensii var. *variegata* E. Morren in Belg. Hort. 1866: 129, t. 9.

A variegated form with white-tipped branches was first noticed in Messrs.

Jacob-Makoy's garden at Liège in 1865, and introduced into England by Messrs. Bull in the same year. There it was awarded a Second Class Certificate at the R.H.S. Show on 7 Nov. 1865.

forma **albolineata** (Moore) Alston comb. nov.

S. martensii var. *albo-lineata* Moore in Gard. Chron. 1870: 1535.
S. watsoniana Hort. Sander. in Gard. Chron. xxxiii, 1: 245 (1903).

A form in which the median leaves of the curving portions of the stem are white and the lateral leaves partially so. It was first noticed by Messrs. Perkins & Sons, Coventry, and may be due to a virus, as I have been informed that the white markings become more pronounced in a cool greenhouse.

36. **Selaginella estrellensis** Hieron. in Hedwigia xli: 200 (1902).

Selaginella martensii sensu Donn. Smith, Enum. Pl. Guat. iv: 180 (1895) pro parte; non Spring.
Selaginella mnioides sensu Christ in Dur. & Pittier, Primit. Fl. Costaric. i, 3: 254 (1896) pro parte; non Spring.

SALVADOR. Above Hacienda Los Planos, NE. of Metapan, Cerro Miramundo, 1,890–2,400 m., *Carlson 890* (T).

COSTA RICA. Vicinity of Coliblanco, 1,950 m., *Maxon 310* (NY); La Palma, Prov. S. José, 1,400 m., *Brade 832* (NY), *Standley 33007* (W); Cachi, 1,200 m., *Lankester 627* (BM; W); Estrella, Prov. Cartago, 1,345 m., *Cooper 6062* (BM; K; NY; W, type collection), *Standley 39171* (W), *39189* (W), *39273* (W); Agua Caliente, near Cartago, *Lehmann 71* (P); San José de Costa Rica, 1,525 m., *Lehmann 24* (P); Las Nubes, Prov. S. José, 1,500–1,900 m., *Standley 38352* (W), *38647* (W); Candelaria, 1,600 m., *Brade 837* (BD); lieux frais, ombragés Roble, Massif de l'Irazu, *Tonduz 4170* (W); region of La Esperanza, south slope of Volcán de Irazú, *Standley 35377* (W); forêts de la Carpinteria, *Pittier 118* (W); Cerro de la Carpinteria, 1,500–1,850 m., *Standley 35566* (W), *35595* (W), *35620* (W); bois humides des collines supérieures de Santiago près San Ramon, 1,200–1,300 m., *Brenes 14175* (W); Vara Blanca de Sarapiqui, between Poás and Barba volcanoes, 1,800 m., *Skutch 3371* (W); Cerro de las Caricias, north of San Isidro, Prov. de Heredia, 2,000–2,400 m., *Standley & Valerio 51971* (W); Viento Fresco, Prov. de Alajuela, 1,600–1,900 m., *Standley & Torres 47763* (W); La Hondura, 1,450 m., *Valerio 4* (W).

Geographical range: confined to the mountains of Costa Rica and Salvador.

S. estrellensis Hieron. is somewhat variable and resembles *S. martensii*, but may usually be distinguished by one or more of the following characters. The stems are usually prostrate with rhizophores springing mostly at right-angles from the lower two-thirds of the stem. The lateral leaves are more acute, more cordate on the upper side at base where they overlap the stem, usually long-ciliate at base on the upper side. The median leaves are nearly always long-ciliate and more polished than in *S. martensii*.

37. **Selaginella mollis** A. Braun in Ann. Sci. Nat. sér. 5, iii: 276 (1865).

Selaginella schizobasis sensu Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 709 (1886), pro parte; non Bak.
Selaginella schrammii Hieron. ex Standl. in Amer. Fern Journ. xvii: 8 (1927), pro parte quoad pl. panam.

MEXICO. Chiapas: *Ghiesbreght 603* (BM), *604* (BM, K), *605* (BM); San Cristobal, *Munch 16* (P).

BRITISH HONDURAS. Shady creek bank, Big Creek, 30 m., *Schipp 925* (BM; BD).

NICARAGUA. Near Braggman's Bluff, *Englesing 72* (BM; W); Sangsangta District, *Schramm 20* (W); Cape Gracias a Dios, *Schramm* (W); near Bluefields, *Danneberger* (W); Waspuk District, *Schramm 55* (BD); near El Recreo, on Rio Mico, 30 m., *Standley 19176* (T), *19695* (T).

PANAMA. Santa Rita Trail, *Cowell 116* (NY); Barro Colorado Id., *Standley 31389* (W), *41090* (W); between Frijoles and Monte Lirio, 30 m., *Killip 12149* (NY); Colon, forests around Porto Bello, 5–200 m., *Maxon 5739* (BM); forest, El Valle de Anton, Prov. Coclé, 1,000 m., *Alston 8741* (BM).

Geographical range: Mexico to Colombia.

38. **Selaginella minima** Spring in Bull. Acad. Brux. x: 139 (1843); in Mém. Acad. R. Belg. xxiv: 86 (1850).—Bak., Handb. Fern-Allies: 84 (1887).

COSTA RICA. Río Rosales, Grecia, 850 m., *Valerio 1806* (W), *2086* (W).

PANAMA. Bald Hill, S. José Id., Perlas Arch., grassland on clay banks and about base of grass clumps, *Johnston 878* (BM).

Geographical range: also in French Guiana.

S. broadwayi Hieron. from Trinidad is very close and may be conspecific.

39. **Selaginella porphyrospora** A. Braun in Ann. Sci. Nat. sér. 5, iii: 286 (1865).

Selaginella bulbifera Bak. in Gard. Chron. 1867: 783, 950.—A. Braun in Index Sem. Hort. Berol. 1867, App. 3: 1.—J. Smith, Ferns: Brit. & For. ed. 2: 325 (1896).

Selaginella binervis Liebm. ex Fourn., Mex. Pl. 148 (1872), in syn.—Bak. in Journ. of Bot. xxii: 112 (1884).—Donn. Smith, Enum. Pl. Guat. i: 68 (1889), op. cit. ii: 91 (1891).—Hieron. in Engl., Bot. Jahrb. xxxiv: 579 (1905).—Alston in Journ. of Bot. lxxi: 243 (1933).—Conzatti, Fl. Tax. Mex. i: 141 (1946).

Selaginella albonitens sensu Christ in Dur. & Pittier, Primit. Fl. Costaric. i. 3: 255 (1896); non Spring.

Selaginella bernoullii Hieron. in Hedwigia xli: 192 (1902).

MEXICO. Jalisco: Rio Blanco, *Palmer 558* (BM; NY; W); near Guadalajara, shaded wet rocks, *Pringle 2593* (BM; NY; W). Hidalgo: Wet banks, barranca below Trinidad Iron Works, 1,675 m., *Pringle 13260* (W). Vera Cruz: *Sartorius* (BD; BM, type of *S. porphyrospora* A. Braun); Dos Puentes, S. Antonio Huatusco, *Liebmann* (H; K, type of *S. binervis* Liebm.); Santa Maria Alpatlahua, *Liebmann 2036* (H); Zacuapan, *Purpus 7438* (W). Michoacan: Cerro San Miguel, 610 m., *Arsène 5206* (W), *6648* (W), *10684* (W), *10685* (W); Cerro Azul, *Arsène 5182* (BM; W), *5362* (W), *10682* (W), *Exsic. Ros. 47* (W); Campanario, Morelia, *Arsène 6784* (W). Mexico: El Oro, *Rangel in Arsène 10683* (W). Morelos: San Antonio, near Cuernavaca, *Rose & Painter 6943* (BM; W); near El Parque, *Rose & Painter 7250* pro parte (BM), *Orcutt 4401* (W). Puebla: Tezuitlan, *Orcutt 4035* (BM). Chiapas: Cerro del Boqueron, *Purpus 6720* (BM; W); Finca Irlanda, *Purpus 6721* (BM; W).

GUATEMALA. Without exact locality, *Watson 106b* (W); near Tecpam, 2,100 m., *Skutch 627* (BM; W); roadside bank, Tecpam to Paques, Dept. Chimaltenango, 2,400 m., *Skutch 699* (BM; W); Salama trail, above Llano Grande, on dripping rocks, *Maxon & Hay 3413* (NY; W); Cobán, Alta Verapaz, 1,350 m., *Johnson 981* (BM); wet ground near Cobán, 1,400 m., *Türckheim II.* 2036 (BM; W); Pansamala, Alta Verapaz, 1,150 m., *Türckheim ed. J. D. S. 1578* (W), *832* (W); in wood, Chicoyan, 1,350 m., *Türckheim II. 1369* (W); on rocks in shade, oak-pine woods, Río Sitio Nuevo, between Santa Rosalía and the first waterfall, 1,200–1,500 m., *Steyermark 42203* (BM); on wet ground, above San Juan Ixcoy, 2,400 m., *Steyermark 50006* (BM); Chihob, Alta Verapaz, 900 m., *Johnson 823* (BM); along Rio Frío, Dept. Izabal, 75 m., *Steyermark 39925* (BM); Finca Moca, Dept. Suchitepequez, 1,000 m., *Muenscher 12170* (BM).

HONDURAS. Wet shaded bank, vicinity of Siguatepeque, Dept. Comayagua, 1,080–1,400 m., *Standley 56217* (BM; W); Dept. of Morazán, cloud forest on Mt. Uyoca, 2,000 m., *Williams & Molina 14940* (BM); E. slope of Peña Blanca, San Juancito Mts., Dept. Francisco Morazan, 1,900–2,000 m., *Morton 7307* (BM).

SALVADOR. Volcan Santa Ana, 1,800 m., *Schultze-Jena 799* (BD).

NICARAGUA. *Ringgold & Rodgers 3* (W); Mombacho Volcano, 1,050 m., in wet forest, *Maxon, Harvey & Valentine 7797* (BM; W).

COSTA RICA. Alajuela, *Polakowsky 115* (BM); Desamparados, *Tonduz 927* (W); Faldas del Volcan Barba, 1,800 m., *Valerio 1* (W); road from Vara Blanca (between Poás and Barba Volcanoes) to La Concordia, 1,600–1,950 m., *Maxon & Harvey 8485* (W); Vara Blanca de Sarapiqui, between Poás and Barba Volcanoes, 1,800 m., *Skutch 3375* (W), 1,500–1,750 m., *Skutch 3190* (BM; W); Piedra Blanca, 2,450 m., *Valerio 19* (W); Tablazo, 1,800 m., *Valerio 1884* (W); west slope of Irazu, *Lehmann 1032* (BM; W); near Fraijanes, Prov. Alajuela, 1,500–1,700 m., *Standley & Torres 47493* (W), *47704* (BM; W); Dulce Nombre, Prov. Cartago, 1,400 m., *Standley 35950* (W); El Muneco, south of Navarro, Prov. Cartago, 1,400 m., *Standley 33684* (W); Yerba Buena, NE. of San Isidro Prov. Heredia, 2,000 m., *Standley & Valerio 49176* (W), *49696* (BM; W); Las Nubes, Prov. San José, 1,500–1,900 m., *Standley 38351* (W), *38358* (W), *38619* (W), *38625* (W), *Valerio 2238* (W); La Palma, Prov. San José, 1,500–1,600 m., *Standley 32934* (W), *38219* (W), *Valerio 2243* (W); road from La Palma to La Hondura, 1,500–1,700 m., *Maxon & Harvey 8084* (W); La Hondura, Prov. de S. José, 1,300–1,700 m., *Standley 37580* (W), *37585* (W), *37748* (W), *Standley & Valerio 51865* (BM; W); near Santa Maria de Dota, 1,500–1,800 m., *Standley 41670* (W); Candeleria, *Brade 836* (BD; NY); La Palma, *Brade 72* (BM), *222* (BM; W), *284* (BD; NY), *Standley 38063* (W); Navarro, *Lankester* (BM).

PANAMA. Valley of R. Piarnasta, above El Boquete, 1,550–1,650 m., *Killip 5402* (W); Holcomb's trail above El Boquete, 1,650–1,925 m., *Maxon 5642* (BM).

Geographical range: Mexico to Panama.

The following specimens have apparently entirely glabrous leaves and the false veins are not visible, but I believe that they are only a form of *S. porphyrospora*. One of the specimens (*Tonduz 10694*) was referred by Christ to *S. karsteniana* (in Pittier, Primit. Fl. Costaric. iii, 1: 61 (1901)).

COSTA RICA. Volcán de Barba, 2,300 m., *Valerio 2362* (W); Volcán de Turrialba, near Finca del Volcan de Turrialba, 2,000–2,400 m., *Standley 35029* (W), *35046* (W), *35151* (W); forêts de l'Achiote, Volcán de Poas, *Tonduz 10696* (W), 2,200 m., *10694* (W); road from Vara Blanca to La Concordia, 1,600–1,950 m., *Maxon & Harvey 8463*

(W); Las Nubes, Provincia de San José, 1,500–1,900 m., *Standley 38554* (W); near Finca La Cima, above Los Lotes, north of El Copey, Prov. de San José, 2,100–2,400 m., *Standley 42644* (W); near Fraijanes, Prov. Alajuela, 1,500–1,700 m., *Standley & Torres 47489* (W).

Baker (loc. cit. (1867)) stated that *S. bulbifera* was unknown in a wild state, but J. Smith (loc. cit. (1896)) stated that it came from Venezuela, which appears to be an error.

40. **Selaginella orizabensis** Hieron. in Hedwigia xli: 193 (1902); op. cit. xliii: 10 (1904).

Selaginella sartorii A. Braun ex Fourn., Mex. Pl.: 149 (1872), *nom. nud.*; non Hieron.

MEXICO. Vera Cruz: Orizaba, *Müller 268* (NY), *Müller* (type, ex Hieron.), *Weber* (ex Fournier); near Eugenio, Sierra de S. Cristobal, *Sartorius* (ex Hieron.).

Geographical range: confined to the mountains of Vera Cruz.

41. **Selaginella novae-hollandiae** (Sw.) Spring in Bull. Acad. Brux. x: 234 (1843).

Lycopodium novae-hollandiae Sw., Syn. Fil.: 184, 410 (1806).

Selaginella radiata sensu Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 708 (1886).—Christ in Dur. & Pittier, Primit. Fl. Costaric. i, 3: 258 (1896); non *L. radiatum* Aubl.

Selaginella nicaraguensis sensu Donn. Smith, Enum. Pl. Guat. iv: 130 (1895), pro parte; non Bak.—Christ in Pittier, Primit. Fl. Costaric. iii, 1: 62 (1901), pro parte.

Selaginella serpens sensu Donn. Smith., Enum. Pl. Guat. v: 102 (1899); non Spring.

NICARAGUA. Rocky cliff, Masaya, 250 m., *Hitchcock* (W).

COSTA RICA. Rio Grande, mossy rocks in woodland stream-bed, 240 m., *Lankester 604* (BM); Lagarto, *Tonduz 4799* (BM; W); Rio Toro Amarillo, Llanuras de Santa Clara, 300 m., *Donnell Smith 6944* (BM; W); Guápiles, Llanos de Santa Clara, Comarca de Limon, 260 m., *Donnell Smith 5107* (W); Pejivalle, 650 m., on stones, *Valerio 6* (W), *17* (W); near Pejivalle, Prov. Cartago, *c.* 900 m., *Standley & Valerio 46881* (W), *46968* (W); Forêts de Boruca, *Tonduz 4434* (W); Tablazo, *Biolley 108* (W); S. Isidro, near S. Ramón, 1,300 m., *Brenes 14495* (W); near Juan Vindo, R. Chio Distr., 1,200 m., *Brade 829* (BD); Turrialba, *Brade 828* (BD); Aguacate, *Hoffmann 1* (K).

PANAMA. Hills west of Soná, *c.* 500 m., *Allen 1074* (BM).

Geographical range: Nicaragua southwards to Argentina.

42. **Selaginella cladorrhizans** A. Braun in Ann. Sci. Nat. sér. 5, iii: 282 (1865).

MEXICO. Tepic: Trail to Ensenada de Matuchen, near San Blas, *Ferris 5438* (W). Jalisco: Santa Cruz de Vallarta, along stream-bed, 300 m., *Mexia 1276* (BM; W). Colima: Alzada, *Orcutt 4640* (BM). Guerrero: Temisco, damp earth above stream, Sierra Madre del Sur, Distr. Adama, 300 m., *Mexia 8755* (BM); Barranca de la Julia, Temisco, 350 m., *Mexia 8725* (BM).

BRITISH HONDURAS. River Bluffs, El Cayo, *Bartlett 11457* (BM); Rio Grande, *Schipp 8–817* (BM); Sibun River, Gracie Rock, *Gentle 1759* (W).

GUATEMALA. On clay banks, Jocoló, Dept. Izabal, 30 m., *Johnson 987* (BM); Río Santa Isabel, between mouth of Rio Sebol and El Porvenir, 100 m., *Steyermark 45822* (BM), *45854* (BM).

PANAMA. Rio Tapia, Prov. Panama, *Standley 26164* (BM).

Geographical range: Mexico southwards to Venezuela.

43. **Selaginella flagellata** Spring in Bull. Acad. Brux. x: 228 (1843).—Donn. Smith, Enum. Pl. Guat. vii: 65 (1905).

Selaginella rhizophora Bak. in Journ. of Bot. xxii: 244 (1884).

MEXICO. Colima: Nevado de Colima, *Gadow* (BM). Chiapas: Cacahuatan, 550 m., on trees, *Fisher 35398* (BM; W).

GUATEMALA. Chilion near Mazabenango, *Bernoulli 472* (NY); abundant in forest on shady rocks, Finca Mocca, Alta Verapaz, 975 m., *Johnson 97* (W); Cubilquitz, Alta Verapaz, 350 m., *Türckheim II. 772 & ed. D. Smith 8653* (W); banks of Rio Xibana, Finca San José Nil, Retalhuleu, *Hatch & Wilson 402* (W); lowland forest along Río San Román, west of Chinajá, 50 m., *Steyermark 45512* (BM).

NICARAGUA. Sangsangta, Segovia District, *Schramm 2* (W), *18* (W); Bluefields, *Danneberger* (W).

COSTA RICA. Nicoya, *Tonduz 13761b* (BM); Pasoagres, Alajuela Prov., *Lankester 603A* (BM); Cocos Id., *Barclay 2210* (BM).

PANAMA. Near San Juan, *Seemann 29* (K); Chiriqui, *Hart 22a* (K); Corozal Road, Panama, Prov. of Panama, *Standley 26850* (BM); near Panama, *Seemann 32* (K); Gamboa, Canal Zone, *Standley 28424* (BM); Ancon Hill, Canal Zone, *Standley 25171A* (BM); Fort San Lorenzo, Fort Sherman Military Reservation, Canal Zone, *Maxon & Valentine 7000* (W), *7006* (W), *7014* (W); Valley of Masambí, on road to Las Cascadas Plantation, 20–100 m., Canal Zone, *Maxon 4676* (BM; W); San José Island, Perlus Archipelago, *Johnston 344* (BM), *366* (BM), *1049* (BM).

Geographical range: Mexico to Bolivia (*Buchtien 2252*) and French Guiana.

44. **Selaginella exaltata** (Kunze) Spring in Bull. Acad. Brux. x: 234 (1843).—Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 706 (1886).

Lycopodium exaltatum Kunze in Linnaea ix: 8 (1835).

PANAMA. *Hayes 41* (NY), *Cowell 424* (NY); between Mt. Hope and Santa Rita Trail, *Cowell 69* (NY); Obispo Falls, *Hayes 25* (ex Hemsl.); Bismarck, *Williams 476* (NY; W); road from Colon to Gatun, *Celestine 94* (W); near Gatun, *Hayes 49* (BM; W); small island on Gatun Lake, *Ostenfeld 102* (W); Lion Hill, *Howe* (NY); Agua Clara Reservoir, C. Z., *Stevens 555* (W); Bojio Station, *Hayes* (BM); Darien, *Shakespear* (BM); along Sembú R., S. Darien, above tide limit, *Pittier 5554* (W); dense forest along Frijoles R., near Gatun Lake, *Killip 2803* (BM; W); Trinidad R., west of Gatun Lake, *Rowlee 403* (W); along Trinidad R., near sea-level in forest, *Pittier 4004* (W); Perine, San Blas District, *Cooper 249* (W); forests around Puerto Obaldía, San Blas Coast, *Pittier 4325* (W).

Geographical range: Panama southwards to Peru.

Hieronymus, in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 710 (1901), gives also Guatemala, but I have seen no specimens from that country and do not know the basis of the record.

The main stem is articulate, but the lateral branches are without articulations.

45. **Selaginella articulata** (Kunze.) Spring in Flora xxi: 182 (1838); in Ann. Sci. Nat. sér. 2, xi: 228 (1839); in Bull. Acad. Brux. x: 229 (1843).

Lycopodium articulatum Kunze in Linnaea ix: 10 (1835); Farrnkr. i: 243, t. 99 (1847).

PANAMA. El Valle de Anton, 1,000 m., *Alston 8753* (BM), *Allen 1649* (BM), *1904* (BM), *2363* (BM), *Seibert 451* (W).

Geographical range: southwards to Peru.

Originally described by Kunze from a *Poeppig* specimen collected in woods at Tocache Mission in the Dept. of Loreto, Peru. A specimen from Monte Campana, near Tarapoto, *Spruce 4627* (BM) agrees well with the Panama specimens and has, like them, pubescent branches.

46. **Selaginella arthritica** Alston in Archiv. Bot. xi: 43 (1935).

Selaginella conduplicata sensu Spring in Mart., Fl. Bras. i, 2: 129 (1840), pro parte; non Spring (1838); Spring in Mém. Acad. R. Belg. xxiv: 229 (1850) pro parte excl. pl. Bras. & Guian.

Selaginella geniculata var. *conduplicata* (Spring) A. Braun in Ann. Sci. Nat., sér. 5, iii: 303 (1865), pro parte quoad pl. Billberg.

Selaginella geniculata sensu Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 707 (1886); non Spring.

Selaginella anceps sensu Donn. Smith, Enum. Pl. Guat. iv: 179 (1895); v: 102 (1899); non A. Braun.

Selaginella nicaraguensis sensu Donn. Smith, tom. cit.: 180 pro parte.—Christ in Pittier, Primit. Fl. Costaric. iii, 1: 62 (1901), pro parte.

Selaginella geniculata subsp. *elongata* sensu Christ in Bull. Herb. Boiss. sér. 2, vi: 288 (1906); non Klotzsch.

NICARAGUA. Chontales, *Seemann 234* (BM), *Tate 81* (BM); moist mixed forest near El Recreo, on Rio Mico, 30 m., *Standley 19311* (T), *19327* (T).

COSTA RICA. Confluents to Puerto Viejo and Sarapigui, *Biolley 7508* (W); Camillo, *Cooper 573* (W); Piedra del Convento, *Pittier & Tonduz 3577* (W); Boca Culebra, *Pittier 12089* (W); forests of Tuio, 650 m., *Tonduz 11344* (W); Monte Verde, 92 m., *Stork 1668* (W); La Hondura, 1,400 m., *Valerio 12* (W); near El General, Prov. San Jose, 610 m., *Skutch 3896* (BM); Guacimo, 140 m., *Tonduz 14553* (BM); near Angostura, *Polakowsky 446B* (BM), *500* (BM); near Puerto Jimenez, *Cufodonti 218* (BM); Finca Montecristo, R. Reventazon below Cairo, Prov. Limon, *Standley & Valerio 48505* (W); mouth of R. Reventazon, *Cufodonti 479* (BM); Livingston on Reventazon, *Rowlee & Stork 621* (W); Las Delicias, Santa Clara, *Biolley 10661* (W); Santa Clara, *Cooper 10202* (W), *10286* (W); Guapiles, Llanos de Santa Clara, *Donnell Smith 5106* (NY; W); Jimenez, Llanos de Santa Clara, 200 m., *Donnell Smith 5104* (W), *5906B* (NY; W); Surre, Llanuras de Santa Clara, 300 m., *Donnell Smith 6945* (K; NY; W); Turrialba, *Brade 831* (NY); Pirris, 20 m., *Biolley fil. 17401* pro parte (W); Guanacaste, *Brade 841* (NY); near Carmen Station on Indiana Branch, Prov. Limon, 30 m., *Standley & Valerio 48382* (W); La Colombiana Farm, Prov. Limon, 70 m., *Standley 36760* (W), *36798* (W); Naranjos Agrios, Prov. Guanacaste, 600–700 m., *Standley & Valerio 46476* (W); La Tejona, north of Tilarán, Prov. Guanacaste, 600–700 m., *Standley & Valerio 45881* (W); Los Ayotes, near Tilarán, Prov. Guanacaste, 600–700 m., *Standley & Valerio 45455* (W); near Tilarán, Prov. Guanacaste, 500–680 m., *Standley & Valerio 44955* (W); El Silencio, Prov. Guanacaste, 750 m., *Standley & Valerio 44600* (W), *44641* (W), *44755* (W), *44761* (BM; W); near Pejivalle, Prov. Cartago, 900 m., *Standley & Valerio 46891* (W); between Aserri and Tarbaca, Prov. San José, 1,200–1,700 m., *Standley 45278* (W); Cuesta de la Vieja, road to San Carlos, 300 m., *Cook & Doyle 110* (W).

PANAMA. *Parry* (NY), *Miller* (BM); Bocas del Toro, Laguna de Chiriqui, *Hart 2* (W), *33* (W); Rio Tecumen, Prov. Panamá, *Standley 29346* (W); Rio Tapiá, Prov. Panamá, *Killip 2891* (W), *Standley 26131* (W), *26165* (W); near Tapia R., Juan Diaz Region, Prov. Panamá, *Maxon & Harvey 6714* (BM; W), *6725* (BM; W); El Valle de Anton, 1,000 m., *Alston 8690* (BM); Orange River, Juan Diaz, *Killip 2546* (BM; W) *2633* (W), *2783* (W); along Rió Chilibre, *Piper 5668* (W); forests on dry limestone, around Alhajuela Chagres Valley, 30–100 m., *Pittier 2392* (BM; NY); Bismarck, 610 m., *Williams 475* (NY; W); Headquarters of Rio Chinilla, above Nuevo Limón, C.Z., *Maxon 6872* (W), *6874* (W); forests around El Vigiá, C.Z., *Pittier 2393* (W); Obispo, C.Z., *Standley 31693* (W); Río Paraíso, above East Paraíso, C.Z., *Standley 29911* (BM; W); Valley of Masambí, on road to Las Cascadas Plantation, C.Z., 20–100 m., *Maxon 4672* (W); Bojio Station, *Hayes* (BM); Gamboa, C.Z., *Standley 28402* (W), *28414* (W); Fort Sherman, C.Z., *Standley 31099* (W); between Chagres Batteries and Fort San Lorenzo, Fort Sherman Reservation, C.Z., *Maxon & Valentine 7022* (W); Chagres, *Fendler 383* (BM; W); hilly forest around Agua Clara Reservoir, near Gatun, C.Z., 20–30 m., *Maxon 4647* (W); forest along R. Indio de Gatun, C.Z., near sea-level, *Maxon 4873* (W); hills north of Frijoles, C.Z., *Standley 27415* (W), *27456* (W); near Frijoles, C.Z., *Piper 5783* (NY; W); between Frijoles and Monte Lirio, 30 m., *Killip 12160* (NY; W); Río Agua Salud, near Frijoles, C.Z., *Piper 5845* (W); Barro Colorado I., Gatun Lake, *Maxon, Harvey & Valentine 6791* (W), *Seibert 563* (W), *Dodge 3455* (NY; W), *Kenoyer 63* (W), *Standley 31270* (W), *31487* (W), *40840* (W), *Silvestre Avilles 25* (W); Porto Bello, *Billberg* (W), 5–200 m., *Maxon 5741* (BM; W), *5762* (W); around Dos Bocas, Rio Fató Valley, Prov. Colon, 40–80 m., *Pittier 4219* (W).

Geographical range: Nicaragua to Panama, up to 1,700 m.

The type-specimen of *S. conduplicata* was from Brazil (Pará, *Martius*), and is identical with *S. stellata* Spring, as stated in my account of the Brazilian species of *Selaginella*, in Fedde, Repert. Sp. Nov. xl: 309 (1936).

The colour of the leaves varies from dark green to reddish-bronze. The black spots on the leaves of some specimens (e.g. *Pittier 4219*, *Donnell Smith 5106*) appear to be due to a fungus (*Trichothyrium* sp.).

Prostrate, sterile specimens of *S. arthritica* resemble *S. schizobasis* Bak. superficially, but lack the divergent auricles of the axillary leaves. Some specimens of *S. galeottii* are almost erect, but have ovate-lanceolate (not ovate) unequal-sided axillary leaves, ciliate lateral leaves, and biauriculate median leaves.

47. **Selaginella marginata** (Humb. & Bonpl.) Spring in Flora xxii: 194 (1838).

Lycopodium marginatum Humb. & Bonpl. ex Willd., Sp. Pl. v: 41 (1810).—Kunth, Syn. Pl. i: 96 (1822); Nov. Gen. & Spec. i: 39 (1816), vi: 437 (1825).

MEXICO. Sinaloa: Chupaderos, banks, 300–350 m., *Pennell 20187* (W); S. Ignacio, *Ortega 429* (K); La Noria, foothills, *Mexia 222* (W). Durango: La Bajudo, Tamazaba, 300–600 m., *Ortega 4465* (W). Tepic: Acaponeta, *Rose 3148* (BM; NY; W); Tiger Mine, Acaponeta, *Jones 23494* (BM; NY). Vera Cruz: Pinahuastepec, near Perote, *Humboldt & Bonpland* (ex Kunth). Guerrero: La Correa, *Langlassé 371* (K; W).

Geographical range: Mexico, southwards to Uruguay and Northern Argentina.

Humbold & Bonpland's Mexican locality is given in Nov. Gen. & Spec. i: 39, but Willdenow (Sp. Pl. v: 41) gives 'America meridionalis', and Spring (in Mart. Fl. Bras. i, 2: 127 (1840)) excludes the Mexican locality. A. Braun (in Ann. Sci. Nat. sér. 5, iii: 293 (1865)) based his *S. humboldtiana* on a specimen of Humboldt's from the Orinoco which was found in Kunth's herbarium mixed with *S. marginata*. The type-specimen in the Willdenow herbarium is labelled as from the Bocca de Meta, Orinoco, which is the mouth of the R. Meta. It seems quite possible that Humboldt's Mexican specimen was a supposed duplicate sent to Kunth, and it may have been some other species, such as *S. galeottii*.

48. **Selaginella sertata** Spring in Mém. Acad. R. Belg. xxiv: 104 (1850).

Selaginella nicaraguensis Bak. in Journ. of Bot. xxi: 333 (1883).—Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 708, t. 109*A* (1886).

Selaginella galeottii sensu Donn. Smith, Enum. Pl. Guat. iv: 179 (1895); non Spring.

MEXICO. Sinaloa: Camino del Cardonal, Distr. S. Ignacio, *Salazar 429* (W). Tepic (Nayarit): Old Spanish road between Singaita and La Libertad, *Ferris 5546* (W). Jalisco: on sandy river bottom, Quimixto, 5 m., *Mexia 1187* (NY; W). Colima: Alzada, *Orcutt 4617* (W), *4673* (BM; W). Guerrero: Near Acapulco, *Palmer 47* (BM; K; NY; W); wet places on rocky slopes, Pantla, 50 m., *Langlassé 264* (W). Campeche: in inundated forest, Champoton, *Steere 1944* (W).

GUATEMALA. Santa Barbara, Dept. Solola, 420 m., *Shannon 128* (W), *129* pro parte (W).

SALVADOR. La Cebadilla, *Calderon 1227* (NY; W); Sonsonate, 160 m., *Schultze-Jena 670* (BD).

HONDURAS. Amapala, Valle, 10 m., *Valerio 3367* (W).

NICARAGUA. Granada, *Levy 360* (K, type of *S. nicaraguensis*), *Maxon, Harvey & Valentine 7586* (W), *7591* (W); near Laguna de Masaya, 250–300 m., *Hitchcock* (W), *Maxon 7723* (W), *7725* (W), *7746* (W); slopes of Santiago Volcano, Masaya, 300–480 m., *Maxon 7695* (W), *7702* (W); Managua, *Chaves 53* (W); near Chichigalpa, Dept. Chinandega, 90 m., *Standley 11248* (T), *11529* (T).

COSTA RICA. Nicoya, *Sinclair* (K); forests of Nicoya, Prov. Guanacale, *Tonduz 13761a* (BM); Surubres, 250 m., *Biolley 17400* (W); Pasoagres, Prov. Alajuela, *Lankester 603* (BM; W).

PANAMA. *Sinclair 49* (K, type of *S. sertata*); trail from San Felix to Cerro Flor, 100–850 m., *Allen 1959* (BM).

Geographical range: Mexico to Panama, mainly at low elevations.

Sinclair's sheet bears the localities Nicoya and Panama. It may represent two collections, but it is more likely that Hooker thought that Nicoya was in Panama.

This species is usually easily recognized by the prolonged stem apices which root at the tip, giving rise to small plants which often have leaves of a much thicker texture. The lateral leaves diverge at an angle in most specimens, instead of spreading at right angles as in *S. horizontalis* (Presl) Spring: these lateral leaves are often withered, in July, in plants which appear to be resuming active growth after a spell of dry weather, while more typically developed specimens are frequent in November. Similar specimens of *S. schizobasis* Bak. have broader lateral leaves.

49. **Selaginella silvestris** Aspl. in Ark. Bot. XXA, 7: 30, fig. 3–5 (1926).

Selaginella mnioides sensu Christ in Dur. & Pittier, Primit. Fl. Costaric. i, 3: 254 (1896), pro parte; non A. Braun.

Selaginella Poeppigiana sensu Hieron. in Engl., Bot. Jahrb. xxxiv: 581 (1905); non Spring.—Standl. in Publ. 283, Field Mus. Nat. Hist., Bot Ser. x: 84 (1931).

MEXICO. Hidalgo: By stream near Zacualtipan, 2,000 m., *Moore 5286* (BM). Vera Cruz: Head of Orizaba Valley, 2,400 m., *Copeland '168'* (BM); Misantla, *Purpus 5937, pro parte* (W). Chiapas: Tacana, 2,800 m., *Matuda 2911* (K).

GUATEMALA. Along trail, Cafetales, south slope of Volcan Atitlan, 1,525 m., Finca Mocá, Guataloa, *Hatch & Wilson 363* (W); Finca Seamay, Senahu, 920 m., Alta Vera Paz, *Barton 30* (BM), *31* (BM).

HONDURAS. Puerto Sierra, *Wilson 67* (NY); Hacienda la Zumbadora, Dept. Copán, *Blake 7377* (W); wet mountain forest, Lancetilla valley, near Tela, Dept. Atlántida, 20–600 m., *Standley 52752* (W), *54439* (W); near Lancetilla, *Yuncker 4505* (BM); San Juan Junction, in banana plantation, near sea-level, *Dyer A.220* (W); deep forest along Danto R., lower slopes of Mt. Cangrejal, *Yuncker, Koepper & Wagner 8490* (St.).

COSTA RICA. Rancho Flores, 2,043 m., *Tonduz 2082* (W); Llanos de Turubres, south of Puntarenas, *Biolley 2687* (W); confluent of Puerto-Viejo and of Sarapiguin, *Biolley 7507* (W); Vara Blanca, between Poás and Barba volcanoes, 1,600–1,700 m., *Maxon & Harvey 8378* (W); El Arenal, Prov. Guanacaste, 485–600 m., *Standley & Valerio 45189* (W); El Silencio, near Tilaran, Prov. Guanacaste, 750 m., *Standley & Valerio 44569* (W); Los Ayotes, near Tilaran, Prov. Guanacaste, 600–700 m., *Standley & Valerio 45389* (W); Cerro de las Caricias, north of San Isidro, Prov. Heredia, *Standley & Valerio 52268* (BM; W); Cerro de Las Lajas, north of San Isidro, *Standley & Valerio 51442* (W); near Fraijanes, Prov. Alajuela, 1,500–1,700 m., *Standley & Torres 47706* (W); La Palma, Prov. San José, 1,600 m., *Standley 33060* (W), *38064* (W); El Muñeco, south of Navarro, Prov. Cartago, 1,400 m., *Standley 33550* (W); Hacienda El Baul, 350–400 m., *Tonduz & Torres Rojas 7* (W).

PANAMA. Chiriquí, *Hart 29a* (K); Research Lagoon, near Almirante, Prov. Bocas del Toro, *Cooper 141* (NY).

Geographical range: Guatemala southwards to Bolivia.

The exauriculate axillary leaves, distant stem leaves, and flabellate branches are characteristic. The axillary leaves are broader than in *S. kunzeana* A. Braun.

50. **Selaginella galeottii** Spring in Bull. Acad. Brux. x: 230 (1843).—Donn. Smith, Enum. Pl. Guat. ii: 92 (1891).—Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 706 (1886) (as '*galeotti*').—Conzatti Fl. Tax. Mex. i: 141 (1946).

Lycopodium stoloniferum sensu Schlecht. & Cham. in Linnaea v: 622 (1830); non Sw.—Mart. & Gal. in Mém. Acad. R. Brux. xv: 12 (1842).

Lycopodium sulcatum sensu Kunze in Linnaea xviii: 34 (1844); non Desv.

? *Selaginella poeppigiana* var. *mexicana* Spring in Mém. Acad. R. Brux. xxiv: 218 (1850).

Selaginella geniculata sensu Donn. Smith, Enum. Pl. Guat. i: 68; (1889); non Spring.

Selaginella anceps sensu Christ in Dur. & Pittier, Primit. Fl. Costaric. i, 3: 253 (1896), pro parte; non A. Braun.

Selaginella mnioides sensu Hieron. in Engl., Bot. Jahrb. xxxiv: 581 (1905), pro parte; non A. Braun.

Selaginella mandaiana hort. ex Underw. & Bened. in Bailey, Standard Cycl. Hort. vi: 3141 (1917), *nom. nud.*—Graustein in Bot. Gaz. xc: 50, 59 (1930).

MEXICO. Vera Cruz: Jalapa or Mirador, *Galeotti 6606* (P, type; phot. BM); Citlaltepetl, *Gadow* (BM); Zacuapan, *Purpus 2177* (BM), *6439* (BM; W), *8922* (W), *15216* (BM), *15407* (BM), *15413* (BM); Jalapa, *Schiede & Deppe* (BM); near Jalapa, 1,375 m., *Pringle 11804* (W); wet woods along Coatepec road, *Barnes & Land 573* (W); Córdoba, *Bourgeau 1425* (BM), *Woronow 2956* (BM; W), *Fisher 12* (W), *Leeds 137* (W), *Orcutt 3370* (W), *Copeland 'P'* (BM); near Orizaba, *Pringle 6107* (BM; W), *Bourgeau 2371* (W); Orizaba, *Mohr* (W), *Botteri & Mohr* (W); Puebla, Orizaba, *Nicolas* in *Exsic Ros. 72* (W); near Puebla, *Ginest-Antonio 8* (W); Mirador, 1,000 m., in woods, *J. Purpus 130* (W), *131* (W); Coscomatepec, *Kempton & Collins* (W); Metlac R., 900 m., *Copeland 169* (BM). Oaxaca: Near Totontepec, 1130–1,675 m., *Nelson 813* (W); Sierra San Pedro Nolasco, Talea, *Jürgensen 527* (BM); Monte de la Parado, *Sallé* (BM); near Teotalingo, Chinantla, *Liebmann 30* (W); Montaña, Santa Maria, in forest, 1,500 m., *Mexia 9281* (BM). Chiapas: Near Tumbala, 1,320–1,675 m., *Nelson 3348* (W); Mt. Tacana, 1,000–2,000 m., *Matuda 2440* (K).

BRITISH HONDURAS. *Schipp 52* (BM; NY; W).

GUATEMALA. Cerro Victoria, near Barillas, 1,800–2,000 m., Dept. Huehuetenango, *Steyermark 49718* (BM); near Maxbal, north of Barillas, 1,500 m., *Steyermark 48822* (BM); Cerro Negro, 1,600–2,000 m., *Steyermark 51661* (BM); Coban, Dept. Alta Verapaz, *Türckheim ed. Keck 4* (BM; W), *II. 1268* (W), *II. 1363* (BM), *Johnson 8* (W), *Morales 525* (W); Finca Seamay, Senahu, Alta Vera Paz, *Barton 32* (BM); between Copán and Gualán, *Bernoulli & Cario 171* (K); 8 km. NW. of Cubilguitz, 250–300 m., *Steyermark 44685* (BM); between Careha and Lanquin, Dept. Alta Vera Paz, *Lehmann 1375* (BM; W); Samác, Alta Verapaz, 1,375 m., *Johnson 821* (W); Quebradas Secas, 750 m., *Johnson 949* (BM); road between Chamá and Cobán, Dept. Alta Verapaz, 750 m., *Johnson 827* (BM); Rio Coban, 1,200 m., *Johnson 669* (BM); mountains above Trece Aguas, 920 m., Alta Verapaz, *Cook & Doyle 7c* (W); Tamajú, Dept. Alta Verapaz, 1,220 m., *Donnell Smith 1579* (W); Chicoyonito, Dept. Alta Verapaz, 1,320 m., *Donnell Smith 1575* (W); Pansamalá, Dept. Alta Verapaz, 1,220 m., *Türckheim 972* (W); Sanchamac, Dept. Alta Verapaz, 1,345 m., *Türckheim ed. Keck 4a* (W), *Türckheim* (W); near Secanquin, Alta Verapaz, 550 m., *Maxon & Hay 3220* (W); Secanquin, *Cook & Griggs 270* (W).

COSTA RICA. Cachi, 1,200 m., *Lankester 627a* (BM; W); forests of Juan Vinas 1,135 m., *Pittier 1820* (W); near Orosi, Cartago, *Standley 39615* (W), *39625* (W), *39848* (W); Navarro, Cartago, *Torres Rojas 141* (W); El Muñeco, Rio Navarro, Cartago, *Standley & Torres 51021* (W), *51074* (W), *51091* (W), *51183* (W), *51375* (W), *Standley 33459* (W), *33857* (W); La Estrella, Cartago, *Standley 39365* (W); near La Palma, on road to La Hondura, 1,500–1,700 m., *Maxon & Harvey 8089* (W); near La Palma, 1,450–1,550 m., *Maxon 439* (W); La Hondura, 1,400 m., *Valerio 1* (W), *Standley 36608* (W), *37724* (W); Tapautí, 1,200 m., *Valerio 2241* (W).

Geographical range: Mexico to Costa Rica, usually above 1,220 m.

Spring's records for Bolivia (*d'Orbigny*) and Panama (*Sinclair*) were no doubt errors of identification, as stated by Hemsley. The Bolivian specimen was the basis of *S. macrophylla* A. Braun.

The habit of this species sometimes approaches that of certain specimens of *S. arthritica*. *S. arthritica* is usually separable by the absence of long, brittle, marginal cilia at the base of the lateral leaves, while its lateral leaves are denticulate or subentire.

51. **Selaginella intacta** Bak. in Journ. of Bot. xxi: 335 (1883).

Selaginella schiedeana sensu Christ in Donn. Smith, Pl. Guat. iv: 180 (1895); in Pittier, Primit. Fl. Costaric. iii, 1: 62 (1901); non A. Braun.

Selaginella serpens sensu Christ in Dur. & Pittier, Primit. Fl. Costaric. i, 3: 255 (1896) pro parte; non Spring.

Selaginella atirrensis Hieron. in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 711 (1901); in Engl., Bot. Jahrb. xxxiv: 582 (1905).—Christ in Bull. Herb. Boiss. sér. 2, vi: 288 (1906).—Donn. Smith, Enum. Pl. Guat. vii: 73 (1905).

COSTA RICA. Uren R., Talamanca Valley, *Rowlee 341* (NY; W); near Atirro, Prov. Cartago, 650 m., *Donnell Smith 5103* (NY; W, type collection of *S. atirrensis*); Las Nubes, Prov. S. José, 1,500–1,900 m., *Standley 38668* (W); confluent of Puerto Viejo and R. Sarapiqui, *Biolley 7510* (W); La Guaba, 1,900 m., *Valerio 2363* (W); La Palma, 1,500 m., Prov. S. José, *Wercklé 17037* (BM), *Standley 32903* (W), *32952* (W); Chirripo, 31 m., *Tonduz 14552* (BM; W); near railway bridge on Banama R., near Pt. Limon, on rocks, *Pittier 3638* (W); Hamburg Finca, on Rio Reventazón below Cairo, Prov. Limon, 58 m., *Standley & Valerio 48728* (BM), *48852* (W); Yerba Buena, NE. of San Isidro, Prov. Heredia, 2,000 m., *Standley & Valerio 49071* (W); Cerros de Zurqui, NE. of San Isidro, Prov. Heredia, 2,000–2,400 m., *Standley & Valerio 50267* (W), *50484* (W).

PANAMA. In potrero, bank of Changumola R., *Dunlap 348* (W); Holcomb's Trail, above El Boquete, Chiriquí, 1,450–1,650 m., on stones near river, *Maxon 5702* (W).

Geographical range: Costa Rica southwards to Ecuador.

Baker's epithet *intacta* is most inappropriate, as the larger leaves are often strongly ciliate. The dorsal rhizophores help to distinguish this from some of the non-articulate species.

52. **Selaginella diffusa** (Presl) Spring in Bull. Acad. Brux. x: 143 (1843).

Lycopodium diffusum Presl, Rel. Haenk.: 78 (1825).

Selaginella polycephala Bak. in Journ. of Bot. xxi: 332 (1883).

Selaginella kunzeana sensu Christ in Dur. & Pittier, Primit. Fl. Costaric. i, 3: 254 (1896) pro parte; non A. Braun.

COSTA RICA. La Palma, 1,400 m., *Brade ed. Ros. 75* (BM; W), *833* (NY), *Maxon 452* (NY; W); 1,500 m., *Bertolini 597* (W), *598* (W), *Valerio 2244* (W); 1,600 m., *Standley 32955* (W), *33056* (W), *38087* (W); vicinity of La Palma, on the road to La Hondura, 1,500–1,700 m., *Maxon & Harvey 7877* (W), *7953* (W), *8044* (BM; W); La Hondura, Prov. S. José, 1,200–1,500 m., *Standley & Valerio 51887* (F; W), *Standley 36296* (W), *36501* (W); 1,450 m., *Valerio 10* (W); Carillo, 300 m., *Pittier 568* (W), *Cooper 568* (W); Boniela, *Ridgway* (W); on shady bank, Vara Blanca de Sarapiquí, northern slope of Central Cordillera, between Poás and Barba volcanoes, 1,370 m., *Skutch 3493* (St.).

PANAMA. In forest, El Valle de Anton, 1,000 m., *Alston 8759* (BM).

Geographical range: Costa Rica to Trinidad, Venezuela and Colombia, at medium elevations.

The original label on the type-specimen of *Lycopodium diffusum* reads 'Paramo', to which C. Presl has added 'in Panama'. There are no 'páramos' in Panama.

S. polycephala Bak. was originally described from Ocaña, 1,525–1,830 m., *Schlim 493, Holton 82*. It matches *S. diffusa*.

The stem is angled, but not conspicuously sulcate as in *S. eurynota* A. Braun. The texture of the leaves is firmer than *S. sertata* Spring. The median leaves have a slightly thickened margin, and are shortly acuminate (not aristate, as in *S. horizontalis* (Presl) Spring).

53. **Selaginella horizontalis** (Presl) Spring in Bull. Acad. Brux. x: 226 (1843).—A. Braun in Ann. Sci. Nat. sér. 5, iii: 292 (1865).—Alston in Journ. of Bot. lxii: 226 (1934).

Lycopodium horizontale Presl, Rel. Haenk.: 78 (1825).

Selaginella sulcata sensu J. Smith in Seem., Bot. Herald: 243 (1854) pro parte; non Desv.

Selaginella diffusa sensu A. Braun in Ann. Sci. Nat. sér. 5, iii: 302 (1865), pro parte; non Spring.—Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 705 (1886), pro parte.

Selaginella eurynota sensu Hemsl. in Godman & Salvin, Biol. C.-Amer. iii: 706 (1886), pro parte; non A. Braun?

Selaginella fendleri Bak. in Journ. of Bot. xxi: 334 (1883).

Selaginella sylvatica Bak., op. cit. xxii: 25 (1884).

COSTA RICA. Matachin, *Kuntze 81674* (NY); Wafer Bay, Cocos Island, *Svenson 320* (BM).

PANAMA. Santa Rita Trail, *Cowell 136* (NY), *148* (NY); Rio Tapia, Prov. Panama, *Standley 26137* (BM), *28239* (BM), *Maxon & Harvey 6643* (BM); Bella Vista, Prov. Panama, *Killip 12029* (NY); near Juan Diaz R., 75 m., *Killip 2619* (W); near Panama, *Seeman 31* (BM); Rio Tecumen, Prov. Panama, *Standley 26701* (BM); Cerro Gordo, near Culebra, *Standley 25994* (BM); Rio Grande, near Culebra, C.Z., *Pittier 2098* (NY); Culebra, C.Z., *Stevens 938* (W); Empire, *Hayes 228* (BM); Barro Colorado I., *Silvestre Avilles 2* (W), *Kenoyer 61* (W), *Standley 40811* (W), *40861* (W), *Starry 6* (W); Balboa, C.Z., *Standley 25448* (BM); Ancon Hill, 20–75 m., *Seibert 108* (W), 150 m., *Killip 2507* (W), *Standley 25171* (BM), *Alston 8686* (BM); near Gatun, *Standley 27250* (BM); Sosa Hill, Balboa, C.Z., *Standley 25268* (BM); Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29132* (BM); forests around Porto Bello, Prov. Colon, 5–200 m., *Maxon 5768* (BM); Penonome, *Williams 474* (NY); near Fort Kobe, *Allen 2013* (BM); San Pablo, *Blake* (W); Chagres, *Fendler 382* (K, type of *S. fendleri* Bak.); Taboga I., *Killip 2644* (BM); Las Cascadas Plantation, near Summit, C.Z., *Standley 25717* (BM); forest near Madden Dam, C.Z., near sea-level, *Alston 8877* (BM); San José Island, Pearl Archipelago, *Johnston 156* (BM), *343* (BM), *365* (BM), *987* (BM), *1142* (BM).

Geographical range: Costa Rica to Colombia (*Smith 2238*) at low levels.

This species is often prostrate, as is shown in dried specimens by the angle between the stem and the rhizophore, and it is possible that some of the specimens with ascending stems should go under *S. eurynota* A. Braun.

Presl's type, at Prague, was collected by *Haenke*, and is labelled 'ex vallibus

Cordilleris Peruanis', but I have seen no similar plants from Peru, and it probably came from Panama.

54. **Selaginella eurynota** A. Braun in Ann. Sci. Nat. sér. 5, iii: 293 (1865); in Monatsb. Preuss. Akad. Wiss. Berl. 1865: 187, 193 (1866); in Ann. Sci. Nat. sér. 5, iii: 293 (1865).

Selaginella mnioides sensu Christ in Pittier, Primit. Fl. Costaric. iii, 1: 61 (1901); non A. Braun.

GUATEMALA. Cuyotenango, Dept. Suchitepequez, 500 m., *Torres Rojas 144* (NY; W); Hacienda de Guacimo, *U. Fruit Co. 90* (W); Mayatenango, *Bernoulli 33* (K; NY), *Bernoulli & Cario 149* (K); Pueblo Nuevo, Dept. Retalhulen, 1,800 m., *Torres Rojas 555* (W); Finca S. Luis, Dept. Retalhulen, 450 m., *Torres Rojas 557* (BM; W); Coalahuache, Dept. Quezaltenango, 1,800 m., *Torres Rojas 556* (W); Finca El Zapote, Dept. Esquitla, *Muenscher 12173* (W).

NICARAGUA. Mosquito Coast, *Schramm* (W); Sansangta District, *Schramm 23* (W), *53* (W), *54* (W); Cabo Gracias a Dios, *Schramm* (W).

COSTA RICA. Aguacate, *Hoffmann 907* (K, type-collection); Livingston, *Rowlee 34* (NY; W); Hamburg Finca, on Río Reventazon below Cairo, Prov. Limon, 55 m., *Standley & Valerio 48823* (W), *Cufodonti 682* (BM); Rio Grande, *Brade 835* (NY); Finca Montecristo, on R. Reventazón below Cairo, 25 m., Prov. Limon, *Standley & Valerio 48612* (W); Port Limon, at sea-level, *Cook & Doyle 445* (W); Pejivalle, 600 m., Prov. Cartago, *Valerio 16* (W), *2234* (W), 900 m., *Standley & Valerio 46748* (W), *46851* (W), *47175* (W); Forests of Tuis, 650 m., *Tonduz 11345* (W); Santa Clara, *Cooper 10203* (W); between La Junta and Fla, *Rowlee & Stork 614* (W); San Luis de Turrubares, 450 m., *Valerio 1731* (W); near El General, Prov. S. José, 640 m., *Skutch 4020* (BM), 800 m., *2216* (W); banks of Rio Grande near S. Ramon, 900–950 m., *Brenes 14177* (W).

PANAMA. *Cuming 1181* (BM).

Geographical range: Guatemala to Panama, from sea-level to 80 m.

The leaves in this species are normally larger than those of *S. horizontalis* (Presl) Spring, which is common in Panama.

In *S. schizobasis* Bak. the lateral leaves are only about 2·5 times as long as broad, and the auricles of the axillary leaves are divergent.

55. **Selaginella schizobasis** Bak. in Journ. of Bot. xxi: 333 (1883).

Selaginella martensii sensu Donn. Smith, Enum. Pl. Guat. iv: 180 (1895), pro parte; non Spring.
Selaginella tuerckheimii Hieron. ex Donn. Smith, Enum. Pl. Guat. vi: 67 (1903), vii: 65 (1905) *nom. nud.*—E. Hofmann in Sitzb. Akad. Wiss. Wien, Math.-Naturw. Kl. cxxxix: 641 (1930) descr. anat.

MEXICO. Vera Cruz: Orizaba, *Scoville* (NY); Córdoba, *Copeland 'P'* (BM), *Hahn 2025* (K), *Seaton 396* (NY; W), *Carruthers* (BM), *Fisher 3679* (W), *35364* (W), *Matuda 231* (W), *Woronow 2948* (W), *Kerber 15* (BM); Chinameca, *Peniche 41* (W); La Raya, *Gadow* (BM); Potrero Viejo, 600 m., *Copeland 170* (BM); valley of Cordoba, *Bourgeau 1425*, *1655* (W). Tabasco: Santa Cruz, *Rovirosa 539* (NY; W); Ocuapán, near Huimanguillo, *Archer* (W). Chiapas: *Ghiesbreght 605* (K, type); Palenque, *Matuda 3676* (K).

British Honduras. Forest shade, Forest Home, 61 m., *Schipp 8–434* (BD); Roaring Creek, *Lundell 394* (K; NY; W); Craig Point, Sibun R., *Gentle 1396* (BM; W); El Cayo, on limestone, *Lundell 6122* (W); Vaca, El Cayo District, on forest floor, *Gentle 2543* (BM).

Guatemala. Near Puerto Barrios, near sea-level, Dept. Izabal, *Pittier 373* (NY; W), *Standley 24915* (W); Chicbul, Distr. Peten, *Lundell 3377* (BM); Sierra del Mico, Dept. Izabel, *Kellerman 7349* (NY); near Quirigua, Dept. Izabal, *Standley 23735* (NY; W), *23783* (NY; W), *23907* (W), *24174* (NY; W), *24184* (W), *24582* (NY; W), *24671* (W); Cerro de Las Minas, Los Amates to Izabal, *Blake 7810* (W); Quebrades, Dept. Izabal, *Blake 7529* (W), *7540* (W); Cubilquitz, Dept. Alta Verapaz, *Türckheim 8061* (NY; W), *8364* (W), *8365* (K; NY; W); Chihob, Alta Verapaz, 900 m., *Johnson 950* (BM; W); vicinity of Secanquin, 550 m., *Maxon & Hay 3155* (W), *3164* (BM; W); Secanquin, trail to Cahabon, *Goll 32* (W); Cajabon, near Finca Sepacuite, Alta Verapaz, *Cook & Griggs 349* (W); Finca Seamay, Senahu, Alta Verapaz, *Barton 28* (BM), *34* (BM).

Honduras. Near San Juan, *Wilson 238* (Morton MS.); San Pedro Sula, Dept. Santa Barbara, *Thieme 5701* (K; NY; W); near Pito Solo, mountains east of Lake Yojoa, Dept. Cortés, 600–800 m., *Morton 7776* (BM).

Nicaragua. Along Karawala R., *Schramm* (W); Mosquito Coast, *Schramm* (W); Samsangata Distr., *Schramm 22* (W); near Bragman's Bluff, *Englesing 268* (W).

Geographical range: eastern Mexico to Nicaragua.

56. **Selaginella kunzeana** A. Braun in Ann. Sci. Nat. sér. 5, iii: 296 (1865).

Selaginella schiedeana sensu Christ in Dur. & Pittier, Primit. Fl. Costaric. i, 3: 255 (1896), pro parte; non A. Braun.

Mexico. Durango: La Bajada, Tamazula, 300–600 m., *Ortega 4287* (W). Colima: Tuxpan Cañon, *Orcutt 4690* pro parte (W). Mexico: Temascaltepec, in woods on Volcán, *Hinton 2491*.

Costa Rica. Boruca, *Tonduz 4618* (BM; W); on bank near El General, 915 m., *Skutch 3106* (W); trail to Buenos Aires, above Palmar Norte, 830 m., *Allen 5904* (BM).

Geographical range: Mexico southwards to Peru.

Introduced Species

Selaginella braunii Bak.—Maxon in Amer. Fern Journ. xxvii: 111 (1937).—Brown & Correll, Ferns and F. Allies of Louisiana: 158, fig. 48 (1942).

Reported by Maxon (loc. cit.) as naturalized in an old catholic churchyard, St. Mary's, Georgia.

Selaginella kraussiana (Kunze) A. Braun.

United States. Virginia: Arlington, adventive in a lawn, Dec. 1951, *Norton* BM); said to have persisted several years.

This species is the most commonly cultivated, and has been found as an adventive in the British Isles, Chile and Ceylon. It is a native of S. and E. Africa, the Cameroon Mt. and the Azores.

Selaginella plana (Desv.) Hieron.

A commonly cultivated Old World species which has been collected at Sabanas, NE. of Panama City, *Bro. Paul 196* (W). It is now naturalized in Trinidad and Puerto Rico. There is a good figure in Backer, Hand. Suikerriet-Cult. vii: 1, fig. 24 (1928).

EXCLUDED SPECIES

SELAGINELLA ANOMALA sensu Fourn., Mex. Pl.: 148 (1872); non Spring.

MEXICO: in sylva Chiquihuite, *Bourgeau 2156* (ex Fourn.).

S. anomala is a synonym of *S. porelloides*, and this must be a misidentification.

SELAGINELLA CALOSTICHA sensu Christ in Dur. & Pittier, Primit. Fl. Costaric. i, 3: 255 (1896) (as '*colosticha*'); non Spring.

COSTA RICA. Barba, 2,500 m., *Tonduz in Pittier 1908* (ex Christ).

A little-known Venezuelan species. Presumably an error.

SELAGINELLA CHILENSIS (Willd.) Spring.—Conzatti, Fl. Tax. Mex. i: 141 (1946).

MEXICO. *Haenke* (ex Presl).

No doubt an error. This species seems to be the same as *S. usteri* Hieron., and the specimens collected by Haenke were presumably from the Philippines.

SELAGINELLA HOMALIAE A. Braun.—Fourn., Mex. Pl.: 148 (1872).—Hemsl. in Godman & Salvin, Biol. C.-Am. iii: 707 (1886).

MEXICO. Vera Cruz, Valley of Cordova, *Bourgeau 2023* (ex Fourn.).

It is most unlikely that Bourgeau found this Brazilian species in Mexico.

SELAGINELLA LASIOPHYLLA A. Braun.—Urb., Symb. Antill. ix: 392 (1925).

MEXICO. (ex Urban).

The record is presumably an error. *S. lindenii* Spring may have been intended.

SELAGINELLA PANAMENSIS Linden, Cat. No. x: 22 (1855), *nom. nud.*

A. Braun (in Index Sem. Hort. Bot. Berol. 1857, App.: 23 and 1860, App.: 21) reduces this to the Amazonian *S. breynii* Spring.

SELAGINELLA PATULA sensu Christ in Dur. & Pittier, Primit. Fl. Costaric. i, 3: 255 (1896); non (Sw.) Spring.

COSTA RICA. Rio S. Pedro, between General and Buenos-Ayres, *Tonduz in Pittier 3575* (ex Christ).

SELAGINELLA PORELLOIDES sensu Fée, Mém. Fam. Foug. ix: 36 (1857); non Spring.—Conzatti, Fl. Tax. Mex. i: 140 (1946).

MEXICO. Orizaba, 1854, *Schaffner 117* (ex Fée).

This species is known from Guiana and Trinidad. Fée's record was doubtless a misidentification.

SELAGINELLA RUBELLA Moore.—Hieron. in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 710 (1901).

This species was found by Mr. B. S. Williams of Victoria Nurseries, Holloway, on an imported orchid. There is a specimen in Herb. Moore labelled 'Hort. Williams 1870', which is presumably the type. Hieronymus stated that it was probably from Guatemala, but I consider it identical with *S. concinna* (Sw.) Moore from Mauritius.

SELAGINELLA SCANDENS sensu Christ in Dur. & Pittier, Primit. Fl. Costaric. i, 3: 253 (1896; non (Beauv.) Spring.

COSTA RICA. Savanes de Cabagra près de Buenos-Aires, 500–1,000 m., *Tonduz in Pittier 6551* (ex Christ).

This is an African species and the record is doubtless an error.

SELAGINELLA SEEMANNI Bak.

Selaginella sulcata sensu S. Smith in Seem., Bot. Herald: 243 (1885); non Desv.
Selaginella barbacoasensis Hieron. in Hedwigia xliii: 46 (1904).

COLOMBIA. Cacagual I., Choco Intend., on the ground, *Seemann 1006* (BM; K).

Some of the specimens on which J. Smith based his record for Panama of the Brazilian species *S. sulcata* belong to this species and were from the Choco in Colombia.

SELAGINELLA TOMENTOSA Spring.—Hieron. in Engl. & Prantl, Nat. Pflanzenfam. i, 4: 712 (1901).

Hieronymus records this species from 'Isthmus von Panama', but this is probably an error. It was originally described from Gorgona.

SELAGINELLA TRUNCATA sensu Christ in Dur. & Pittier, Primit. Fl. Costaric. i, 3: 254 (1896); non Karst.

COSTA RICA. Carrillo, *Pittier 569*.

Probably an error. The species is South American.

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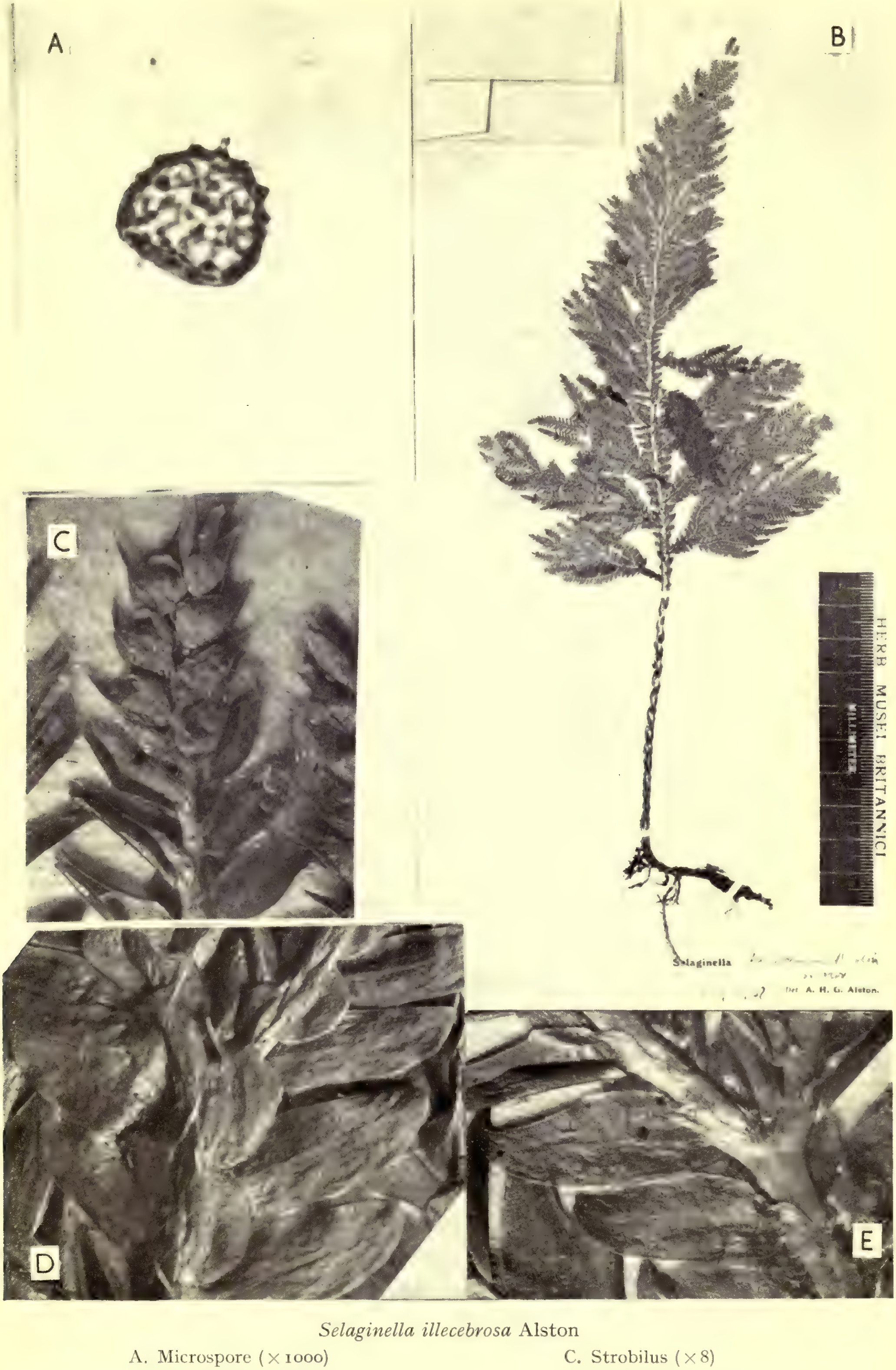
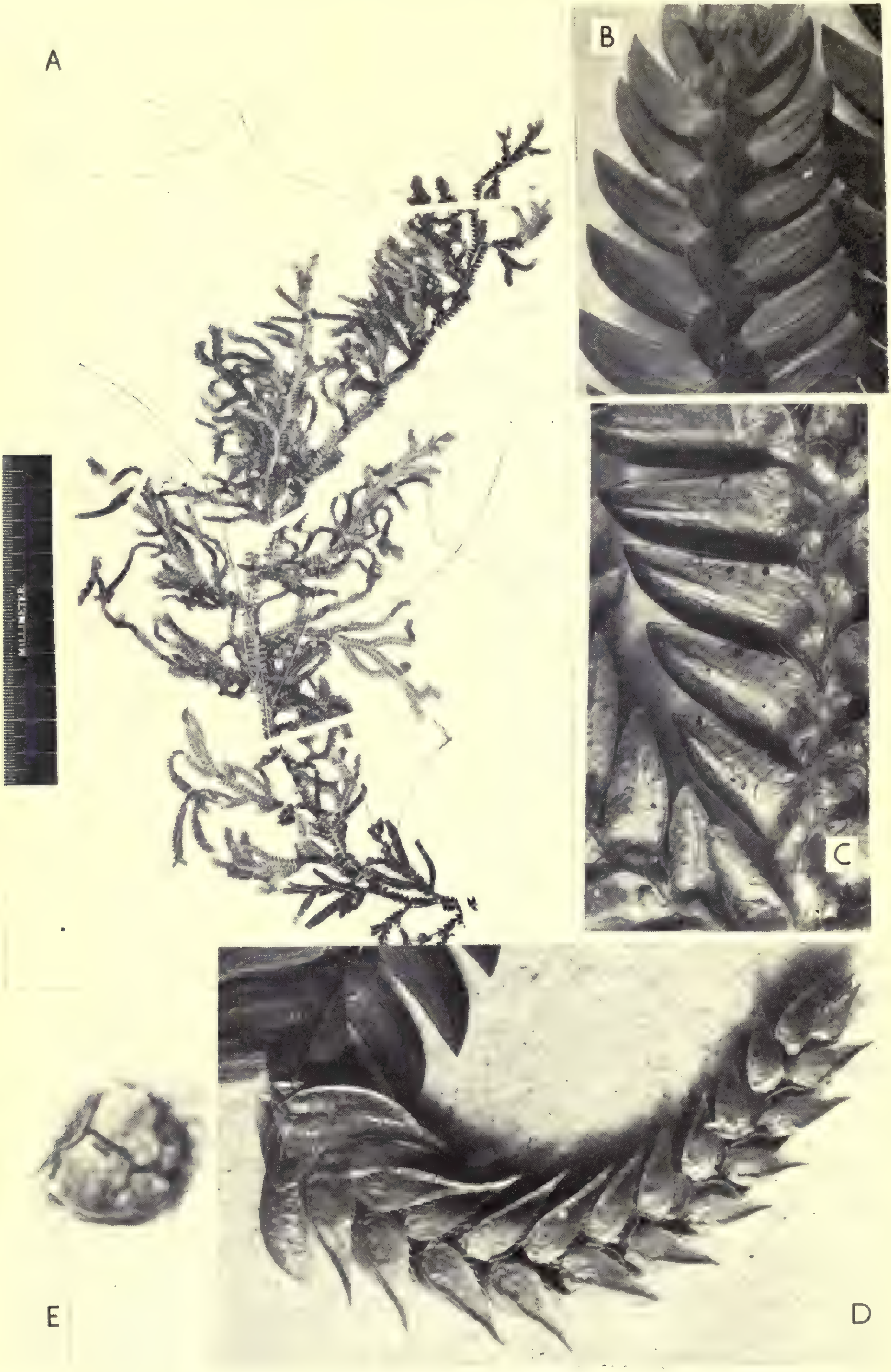

A
B
C
D
E
HERB. MUSEI BRITANNICI
Selaginella
Det. A. H. G. Alston.

Selaginella illecebrosa Alston

A. Microspore (× 1000)
B. Plant (half nat. size)
C. Strobilus (×8)
D. Median leaves (×8)
E. Lateral leaves (×8)



Selaginella idiospora Alston

A. Plant (approx. half nat. size)
B. Median leaves (×8)
C. Lateral leaves (×8)
D. Strobilus (×10)
E. Microspore (×1000)
All from the type-specimen (*Pittier 191*)

BRITISH MUSEUM NATURAL HISTORY

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